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ABSTRACT

"New Standards" is the result of a collaboration between the Learning Research and Development Center and the National Center on Education and the Economy, in partnership with states and urban districts, working to build an assessment system with which to measure students' progress toward meeting national standards at internationally benchmarked levels. The New Standards assessment system has three interrelated components: (1) performance standards; (2) an on-demand examination; and (3) a portfolio system. Standards are provided for English Language Arts, Mathematics, Science, and Applied Learning at the middle school level. (Contains 22 references.) (ASK)

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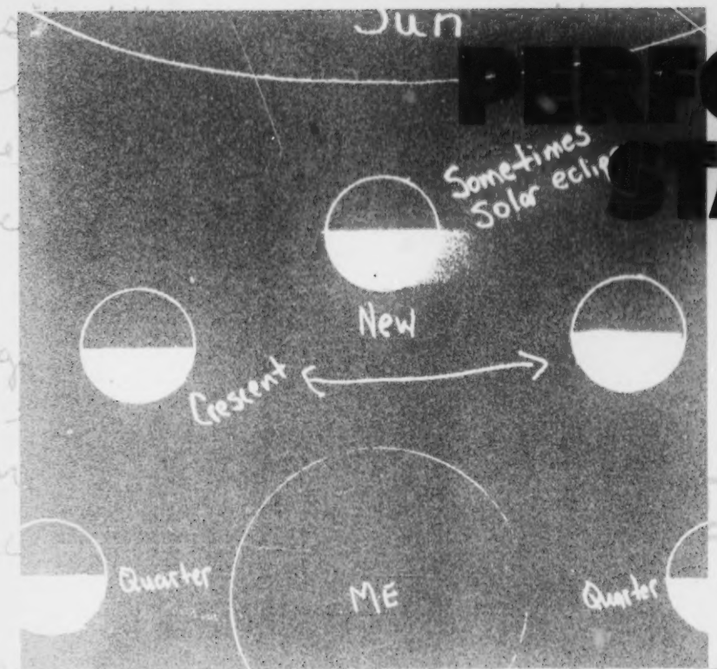

PERFORMANCE STANDARDS

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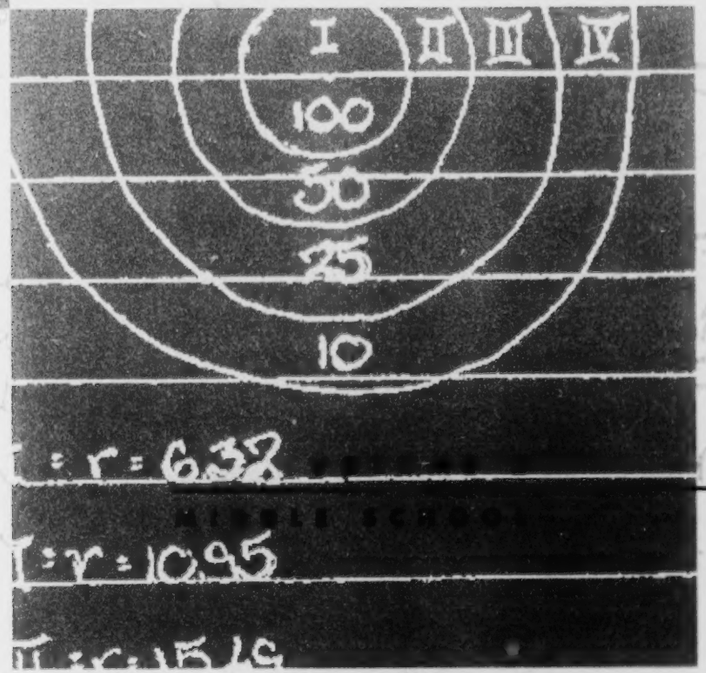
Mathematics

Science

Applied Learning



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NEW
STANDARDS

Consultation Draft

PERFORMANCE STANDARDS

English Language Arts

Mathematics

Science

Applied Learning

VOLUME 2

MIDDLE SCHOOL

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NEW STANDARDS

Consultation Draft

Support for the development of these Performance Standards was provided by:

The Pew Charitable Trusts,
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RESPONDING TO THIS DRAFT

We welcome your response to this Consultation Draft.
A Comments and Feedback Form is enclosed.
Responses need to reach us no later than 3 May 1996 to be considered
in the preparation of the next version of these Performance Standards.
Additional Comments and Feedback Forms can be obtained by contacting
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Introduction

ABOUT NEW STANDARDS

New Standards is a collaboration of the Learning Research and Development Center of the University of Pittsburgh and the National Center on Education and the Economy, in partnership with states and urban districts, working to build an assessment system to measure their students' progress toward meeting national standards at levels that are internationally benchmarked.

The Governing Board includes chief state school officers, governors and their representatives, and others representing the diversity of the partnership, whose jurisdictions enroll nearly half of the Nation's students.

Founded by Lauren Resnick, Director of the Learning Research and Development Center (LRDC), and Marc Tucker, President of the National Center on Education and the Economy, New Standards staff is based at these organizations as well as the American Association for the Advancement of Science, the Fort Worth Independent School District, the National Council of Teachers of English, and the University of California Office of the President. Technical studies are based at LRDC and Northwestern University, advised by leading psychometricians from across the nation.

The New Standards' assessment system has three interrelated components: performance standards, an on-demand examination, and a portfolio system.

The **performance standards** are derived from the national content standards developed by professional organizations, e.g., the National Council of Teachers of Mathematics standards in Mathematics, and consist of two parts:

- **Performance descriptions**—descriptions of what students should know and the ways they should demonstrate the knowledge and skills they have acquired in the four areas assessed by New Standards—English Language Arts, Mathematics, Science, and Applied Learning—at elementary, middle, and high school levels.
- **Work samples and commentaries**—samples of student work selected for their capacity to illustrate the meaning of the performance descriptions together with commentary that shows how the performance descriptions are reflected in the work sample.

The performance standards were endorsed unanimously by the New Standards' Governing Board in June 1995 for widespread consultation in 1995–96.

The on-demand examination, called the **reference examination** because it provides a point of reference to national standards, is currently available in English Language Arts and Mathematics at grades 4, 8, and 10. It assesses those aspects of the performance standards that can be assessed in a limited time frame under standardized conditions. In English Language Arts, this means reading short passages and answering questions, writing first drafts, and editing. In Mathematics, this means short exercises or problems that take five to fifteen minutes and longer problems of up to forty-five minutes' duration. The reference examination stops short of being able to accommodate longer pieces of work—reading several books, writing with revision, conducting investigations in Mathematics and Science, and completing projects in Applied Learning—that are required by New Standards' performance standards and the national consensus content standards from which they are derived.

The **portfolio system** complements the reference examination, providing evidence of the performance standards that depend on extended pieces of work (especially those that show revision) and accumulation of evidence over time. In 1994–95, using draft portfolio handbooks in English Language Arts and Mathematics, 3,000 teachers and almost 60,000 students participated in a field trial of the portfolio system. In addition to handbooks for students, teachers, and administrators, the current system provides example portfolios that contain concrete examples of expectations for students and teachers.

This year the portfolio system trial is being extended to include Science and Applied Learning. The system has been revised to take account of the experience of the first year, with the goal of making it easier to understand and implement.

ABOUT THE PERFORMANCE STANDARDS

We have adopted the distinction between content standards and performance standards that is articulated in *Promises to Keep: Creating High Standards for American Students* (1993), a report commissioned by the National Education Goals Panel. Content standards specify "what students should know and be able to do;" performance standards go the next step to specify "how good is good enough."

These standards are designed to answer the question: how good is good enough?

Where do the standards come from?

The standards are built directly upon the consensus content standards developed by the relevant professional organizations. The Mathematics standards are based directly on the content standards produced by the National Council of Teachers of Mathematics (1989). Similarly the standards for English Language Arts are being developed in concert with the content standards currently being produced by the National Council of Teachers of English and the International Reading Association.

The Science standards are founded both upon the American Association for the Advancement of Science's Project 2061 *Benchmarks for Scientific Literacy* (1993) and the National Research Council's *National Science Education Standards draft* (1995). The Science standards will also take into account the work of the National Science Teachers Association as they revise their *Scope, Sequence, and Coordination Content Core* (1992) and develop assessment tasks.

The case of the Applied Learning standards is a little different. Applied Learning focuses on the requirements for effective participation in the emerging forms of work and work organization characterized by high performance work places. As a newer field of school education, Applied Learning does not yet have a distinct professional constituency producing content standards on which the performance standards can be built. However, a start has been made by the work of the Secretary's Commission on Achieving Necessary Skills which defined "Workplace Know-how" in its report, *Learning a Living: A Blueprint for High Performance* (1992). We have worked from this foundation and from comparable work internationally to produce our own *Framework for Applied Learning* (New Standards, 1994). The Applied Learning standards are being built upon this draft framework.

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Standards for Standards

In recent years several reports on standards development have established "standards for standards;" that is, a set of guidelines for developing standards and criteria for judging their quality. These include the review criteria included in *Promises to Keep*, the American Federation of Teachers' "Criteria for High Quality Standards," published most recently in *Making Standards Matter* (1995), and the "Principles for Education Standards" developed by the Business Task Force on Student Standards and published in *The Challenge of Change* (1995). The headings below are borrowed or adapted from the criteria and principles advocated in those documents.

Standards should establish high standards for all students.

The New Standards' partnership has resolved to abolish the practice of expecting less from poor and minority children and children whose native language is not English. These standards are intended to help bring all students to high levels of performance.

Much of the onus for making this goal a reality rests on the ways the standards are implemented, but part of it lies in the design of the standards themselves. We are working to make the expectations included in the standards as clear as possible. For some standards it has been possible to do this in the performance descriptions. For example, the reading standard includes expectations for students to read widely and deeply. Instead of simply exhorting them to do this, we have given more specific direction by specifying that reading includes at least twenty-five books each year, books of the quality and complexity illustrated in the sample reading list for each grade level. In Mathematics, we have gone beyond simply listing problem solving among our expectations for students. In addition, we set out just what we mean by problem solving and what things we expect students to be able to do in problem solving and mathematical reasoning.

What distinguishes these standards from most others is the use of samples of student work to illustrate what they mean, especially for standards that are hard to pin down clearly in words alone. In the writing standard, for example, the work samples show the expected qualities of writing in the various genres as well as criteria for assessment matched to the genres.

The work samples are intended to be used by teachers, students, and parents, to help them picture work that meets standards and to establish goals to reach for. Students need to know what work that meets standards looks like if they are to strive to produce work of the same quality. They also need to see themselves reflected in the work samples if they are to believe that they too are capable of producing such work. We have taken care to include work samples drawn from a diverse range of students.

Standards should be rigorous and world class.

Is what we are asking of our students as rigorous and demanding as what is expected of young people in other countries—especially those countries whose young people consistently perform as well as or better than ours?

That is the question we are trying to answer when we talk about developing world class standards.

Throughout development of the standards, we have compared them with national and local curricula of other countries, textbooks, assessments, examinations and, where possible, with student work. Ultimately it is in the work that students produce that we will discover whether claims for world class standards can be supported.

We have shared the standards with researchers in several countries and asked them to review them in terms of their own country's standards and in light of what is considered world class in their field. We have asked these reviewers to tell us whether each standard is at least as demanding as its counterparts abroad and whether the set of standards represents an appropriately thorough coverage of material.

The information collected so far indicates that the standards we are defining are world class. To show this we have included "world class connections" throughout this volume. World class connections are examples of the work students in selected countries are expected to do. They are included to allow comparison with these performance standards.

Standards should be useful, developing what is needed for citizenship, employment and life-long learning.

The core disciplines provide the strongest foundation for learning what is needed for citizenship, employment, and life-long learning. We have established explicit standards in each of the core areas of English Language Arts, Mathematics, and Science. But there is more. In particular, it is critical for young people to achieve high standards in Applied Learning—the fourth area we are working on.

Applied Learning is about the capabilities people need to be productive members of society, as individuals who apply the knowledge gained in school and elsewhere to analyze problems and propose solutions, to communicate effectively and coordinate action with others, and to use the tools of the information age workplace.

Applied Learning is not about "job skills" for students who are judged incapable of, or indifferent to, the challenges and opportunities of academic learning. They are the kinds of abilities all young people will need, both in the workplace and in their role as citizens. They are the thinking and reasoning abilities demanded by both colleges and the growing number of high performance workplaces, those that expect employees at every level of the organization to take responsibility for the quality of products and services. Some of these abilities are familiar; they have long been recognized goals of schooling, though they have not necessarily been translated clearly into expectations for student performance. Others break new ground; they are the kinds of abilities we now understand will be needed by everyone in the near future. All are skills attuned to the real world of responsible citizenship and dignified work that values and cultivates mind and spirit.

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Standards for Standards

Standards should be important and focused, parsimonious while including those elements that represent the most important knowledge and skills within the discipline.

As anyone who has been involved in a standards development effort knows, it is easier to add to standards than it is to limit what they cover. It is especially easier to resolve disagreements about the most important things to cover by including everything than it is to resolve the disagreements themselves. We are trying not to take the easier route. We have adopted the principle of parsimony and are trying to practice it. At the same time we are concerned not only to include those elements that represent the most important knowledge and skills within a subject area, but also to make those elements explicit. The approach we have adopted distinguishes between standards as a means of organizing the knowledge and skills of a subject area and as a reference point for assessment, and the program through which the work designed to enable students to achieve the standards is delivered.

For example, the conceptual understanding standards in Mathematics and Science are explicit about the concepts that students should understand at each grade level and in English Language Arts we have established a separate standard for conventions, grammar, and usage. This does not imply that conventions, grammar, and usage should be taught in isolation from other elements of English Language Arts. What it does imply is that the work students do should be designed to help them achieve the standard for conventions. It also implies that conventions should not only be among the things assessed but should also be a focus of explicit reporting of student achievement.

Standards should be manageable given the constraints of time.

This criterion follows very closely on the last one, but focuses particularly on making sure that standards are "doable." One of the features of this standards development effort is the level of interaction among the staff working on the different subject areas. We view the standards for the four areas as a set at each grade level; our publication of the standards by grade level reflects this orientation. This orientation allows us to avoid unnecessary overlaps and duplication across subject areas and to recognize and use opportunities for forging stronger connections among subject areas through the work that students do. A key to ensuring the standards are manageable is making the most of opportunities for student work to do double and even triple duty. These standards include several work samples that demonstrate the way a single project or task can generate student work relevant to more than one standard within a subject area and to standards in more than one subject area.

Standards should be adaptable, permitting flexibility in implementation needed for local control, state and regional variation, and differing individual interests and cultural traditions.

These standards are intended for use in widely differing settings. One approach to tackling the need for flexibility to accommodate local control, state and regional variation, and differing individual interests and leave their translation into more specific statements for users at various levels. We have not adopted that approach. These standards need to be specific enough to guide the New Standards' assessment system; we have tried to make them specific enough to do so. We have also tried to achieve the necessary degree of specificity without unduly limiting the kinds of flexibility outlined above. As we have already mentioned, we are concerned to ensure that the work samples included to show the quality of work expected for meeting the standards come from the work of a diverse range of students. However, the specificity needed for standards intended to guide an assessment system does place limits on flexibility. To tackle these apparently contradictory demands on the standards, we have adopted the notion of "substitution." This means that when users of these standards identify elements in the standards that are inconsistent with decisions made at the local level, they can substitute their own. An example of this is the Reading standard in English Language Arts. The Reading standard states that students should read and comprehend, and specifies that they should read material of the quality and complexity illustrated in the sample reading list equivalent to twenty-five books each year. We have included the reading list so as to be clear about the quality of reading material we are talking about at each grade level. But we would not claim that this is the only reading list that would be appropriate. Thus, users who have established their own lists and are satisfied with them can replace the lists provided with their own. There is one important proviso, however. Substitution only works where what is added to the standards is comparable with the material it replaces in terms of both quality and quantity of expectation.

Standards should be clear and usable.

Making standards sufficiently clear so that parents, teachers, and students can understand what they mean and what the standards require of them is essential to the purpose for establishing standards in the first place. It is also a challenge because while all of these groups need to understand what the standards are, the kinds of information they need are different. The most obvious difference is between the way in which the standards need to be presented to elementary school students so that they know what they should be striving to achieve and the way in which those same standards need to be presented to teachers so that they can help their students get there. If the standards were written only in a form that elementary school students could access, we would have to leave out information teachers need to do their job.

These standards are being presented in several formats. This version of the standards is written primarily for teachers. It includes technical language about the subject matter of the standards and terms that educators use to describe differences in the quality of work students produce. It could be described as a technical document. That does not mean that parents and students should not have access to it, but it does mean that it includes language that may be difficult for students to comprehend and more detail than some parents may want to deal with.

Another version of the standards is in preparation. It is being written with parents and the community in general in mind. The standards will be the same but they will be explained in less technical language.

Standards should be reflective of broad consensus building, resulting from an iterative process of comment, feedback, and revision including educators and the general public.

This consultation draft is the result of revisions of earlier drafts on the basis of comment and feedback from reviewers nominated by the New Standards' partners and the New Standards' advisory committees for each of the subject areas, as well as other educators. Earlier drafts have also been the subject of review by focus groups of parents and other members of the general public.

This draft is being made available widely as the basis for review and comment through to the spring of 1996. A final version will be prepared for endorsement by the New Standards' Governing Board in June 1996.

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How Will the Performance Standards be Used?

The primary audience for these performance standards is teachers. We hope that teachers will use the standards to:

- help students and parents understand what work that meets standards looks like;
- inform discussions with their colleagues as they plan programs to help students learn to high standards;
- challenge assumptions about what we can expect from students;
- communicate the meaning of high standards to district administrators, school board members, and the public so they can work together to build learning environments that challenge all students.

New Standards will use the performance standards to provide:

- the basis of design specifications for the New Standards' assessment system;
- the basis for reporting student scores on assessments within the New Standards' system; and
- the basis for linking the New Standards' assessment system with the standards and assessment systems of the members of the New Standards' partnership.

Design specifications for the New Standards' assessment system

The New Standards' assessment system has two components: portfolios of work demonstrating performances produced by students over extended periods of time and with opportunities for revision; and examinations (known as reference examinations) completed under on-demand conditions.

The portfolio system has already been developed and trialed in English Language Arts and Mathematics, and reference examinations in those subjects have been developed and administered on a pilot basis. The performance standards will provide the basis of design specifications for the portfolio and examination systems in English Language Arts and Mathematics as these are progressively revised and refined. They will similarly provide the basis of design specifications for development of the assessment systems for Science and Applied Learning.

Student scores on assessments reported by standards

Student scores on assessments within the New Standards' system will be reported by standards; that is, student achievement will be reported in the form of a "profile" of scores, with each score reporting achievement in relation to one of the performance standards. Reporting students' scores in this way will provide richer and more comprehensive information about student achievement than can be provided by a single score.

Linking the New Standards' system with partners' standards and assessment systems

"Linking" is the process of establishing the extent and degree of match between the New Standards' system and those of the New Standards' partners. It is an essential step in the process of enabling partners to make decisions about their use of the New Standards' system, either in part or as a whole.

Linking is crucial for assuring that student work is assessed according to the same standards that guided its production.

The performance standards will provide the initial point of reference for the linking process. While comprehensive linking of assessment systems will require the further step of linking scores on performances, linking standards is a necessary first step and will provide a good indication of the potential for linking New Standards with partners' systems.

The linking process is underway with a small number of partners. This work has produced a protocol to guide the process. Linking will take place concurrently with the consultation and review phase of development of the performance standards. This will make it possible for the results of the linking process to inform review of the performance standards prior to their presentation to the New Standards' Governing Board for adoption in June 1996.

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How to Read These Standards

The standards for middle school are set out in an overview on page 10. The overview provides only the names of the standards for each of the four areas: English Language Arts, Mathematics, Science, and Applied Learning. To help you keep the complete set of standards in your mind as you work through this volume we have included a bar listing all the standards for middle school along the top of most pages.

Performance descriptions tell what students are expected to know and be able to do.

Turn to the performance descriptions for English Language Arts on page 12. Each standard has a performance description. The performance description is a narrative description of what students are expected to know and be able to do.

Middle school level means the end of eighth grade.

The standards for middle school are set at the level of achievement expected of students at about the end of eighth grade. Some students will achieve this level of performance earlier than the end of eighth grade. Some students will reach it later than the end of eighth grade.

Most standards are made up of several parts.

Most of the standards are made up of several parts, for example, the Reading standard has five parts.

The bold type shows what students should know and be able to do.

What is shown in bold type are the things students should know and be able to do.

Examples are the kinds of work students might do to demonstrate their achievement of the standards.

Immediately following the bold-typed description of the standard are examples of the kinds of work students might do to demonstrate their achievement. The examples also indicate the nature and complexity of activities that are appropriate to expect of students at the grade level. However, we chose the word "example" deliberately. The examples are intended only to show the kinds of work that students might do and to stimulate ideas for further kinds of work. None of the kinds of work shown in the examples is necessarily required to meet the standard.

Cross-references highlight examples of work that could meet the requirements of standards from two or more subject areas.

In a couple of instances, the examples that go with the English Language Arts performance descriptions include a cross-reference to one of the other subject areas. The cross-references highlight examples for which the same work, and possibly the same piece of work, may enable students to demonstrate their achievement of standards from more than one subject matter.

Most cross-references are to Applied Learning.

Most commonly the cross-reference is to Applied Learning. Applied Learning is not a subject area in its own right. It is expected that Applied Learning activities will generally take place within a subject such as English. The cross-references show work that may provide a vehicle for demonstrating standards within one or more subject areas as well as standards for Applied Learning.

Some cross-references also show the possibilities for using work from Mathematics or Science to demonstrate English Language Arts standards, and vice versa.

We have not tried to highlight every possible cross-reference, only to give an indication of the possibilities.

Margin notes draw attention to particular aspects of the standards.

The notes in the margin draw attention to particular aspects of the standards, such as the resources to which students need access in order to meet the requirements of the standards.

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Comparing the grade levels.

Each page showing performance descriptions has a note in the margin that directs attention to the Appendices which show the performance descriptions at each of the three grade levels: elementary, middle and high school.

Work samples and commentaries.

Next, turn to the work samples and commentaries that appear on the pages immediately following the performance descriptions.

Work samples illustrate "how good is good enough."

Each work sample is a genuine piece of student work. We have selected it because it illustrates the quality of work expected for one or more of the standards. In other words, it illustrates "how good is good enough."

(See "Not all standards are the same" below for more detail on how work samples illustrate standards.)

The commentary explains *why* the work illustrates how good is good enough.

The commentary that goes with each work sample is intended to help make sense of why the work shows how good is good enough. The commentary explains the task on which the student worked and the circumstances under which the work was completed, and draws attention to the qualities of the work with direct reference to the performance descriptions for the relevant standards.

The commentary also notes our reservations about the work.

The commentary also draws attention to any reservations we have about the student work.

In all cases, the work samples are genuine student work. While they provide valuable platforms from which to illustrate aspects of the standards, many samples are not "perfect" in every respect. Some, for example, include spelling errors, clumsy grammatical constructions, or errors of calculation. We think it is important that the standards be illustrated by means of authentic work samples and accordingly have made no attempt to doctor the work in order to correct these imperfections: the work has been included "warts and all". Where errors occur, we have included a note drawing attention to the nature of the mistakes and commenting on their significance in the context of the work. In some cases, for example, the work was produced as a first draft only (in which case it would be expected that the errors would be corrected in work presented as finished work), or produced by a student with limited English language proficiency, or there is evidence in the rest of the work to suggest that the error was a slip rather than an error in conceptual understanding.

In other words, we have tried to adopt reasonable expectations for correctness, but not to overlook errors where they arise. We have also resolved to apply those expectations consistently to all the work samples. We have paid attention to spelling, for example, not only in the work samples included to illustrate the English Language Arts standards, but also in those samples included to illustrate standards in the other subject areas. Similarly, we are also reviewing all work samples for accuracy in relation to mathematical and scientific content.

Performance Standards = performance descriptions + work samples + commentaries on the work samples.

Performance standards are therefore made up of a combination of performance descriptions, work samples, and commentaries on the work samples:

The performance descriptions tell what students should know and be able to do.

The work samples show what work that is judged good enough looks like.

The commentaries explain why the work is good enough with reference to the performance description.

A work sample may illustrate more than one standard.

Often the work samples illustrate the quality of work expected for more than one standard. For example, some of the work samples selected to illustrate parts of the Writing standard also illustrate expectations for the Conventions standard, or for the Literature standard, or possibly even both.

"Analysis of *The Old Man and The Sea*" (see page 28) is an example of a work sample that illustrates more than one standard in English Language Arts.

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How to Read These Standards

A single work sample may illustrate standards from more than one subject area.

Similarly, a single work sample may illustrate standards drawn from more than one subject area. For example, a project completed for Mathematics Standard 8, Putting Mathematics to Work, may also illustrate the report writing part of English Language Arts Standard 2, Writing. It may also qualify as a project within the requirements of Applied Learning Standard 1, Problem Solving.

"A New Look on a Budget" (see page 44) is an example of a work sample that illustrates standards from more than one subject area.

Standards are highlighted in the bar at the top of the page.

The bar along the top of the pages showing student work highlights the standards that are illustrated by each work sample.

World class connections provide a basis for comparison.

On most pages showing work samples and commentaries we have included an example of a standard, a portion of the curriculum, or a student activity drawn from material collected from other countries. These examples provide a basis for comparison with the performance standards. The full list of references from which these examples are drawn is shown on pages 104-105.

Not all standards are the same.

As you read these standards it will become apparent that the standards are not all the same. The most obvious difference is the way in which the performance descriptions are written. We have not imposed a single style on the ways in which the standards are written, because the various standards have different purposes that lend themselves to different kinds of presentation. Nevertheless, there are some patterns. We have identified three categories or kinds of standards, distinguished by their relationship to products of student learning and by the range of evidence required to demonstrate achievement of the standards. The distinctions are broad rather than neat, and we have sought only to define them generally rather than precisely.

The differences among the standards have consequences for what it means to meet a standard and, therefore, for the ways in which we can use samples of student work to illustrate what work that is good enough looks like.

Standards that describe a piece of work.

One kind of standard is characterized by the Writing standard in English Language Arts. Each part of this standard literally describes a piece of work that students are expected to produce, and the knowledge and skills that should be evident in that work. For this standard there is a one to one relationship between each part of the standard and a piece of work.

Standards that fit this category generally are:
English Language Arts Standards 1, 2, and 5;
Mathematics Standard 8;
Science Standard 8;
Applied Learning Standards 1, 2, and 5.

In the case of Mathematics Standard 8, Putting Mathematics to Work, Science Standard 8, Scientific Investigation, and Applied Learning Standard 1, Problem Solving, there is a one to one relationship between the standard as a whole and a piece of work.

Standards of this kind have several features:

- A single piece of work can meet the standard. In fact all of the requirements of the standard usually must be evident in a single piece of work for it to be judged as meeting the standard.
- The qualities that must be evident in a piece of work for it to meet the standard can be stated explicitly and are listed in bullet points as part of the bold-typed performance description. These qualities can be thought of as assessment criteria or as a rubric for work that meets the standard.

Commentaries make judgments about the whole piece of work.

Commentaries on work samples that illustrate these standards make judgments about the whole piece of work.

See, for example, "Paper Towels" on page 56.

Standards that focus exclusively on conceptual understanding.

A second kind of standard is characterized by Mathematics Standard 1, Number and Operation Concepts. This standard focuses exclusively on conceptual understanding.

Standards that fit this category generally are:
Mathematics Standards 1, 2, 3, and 4;
Science Standards 1, 2, 3, and 4.

These standards have several features:

- The standard comprises a number of distinct parts. It is most unlikely that any single piece of work will demonstrate all parts of the standard. In fact, it is common for a single piece of work to relate only to some aspects of one part of the standard. Thus, the standard can usually only be met by multiple pieces of work.

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- Conceptual understanding is developmental. Any one piece of work may contain elements of conceptual understanding that are below what is expected for the grade level and elements that either meet or exceed what is expected for the grade level. Judging whether the work is "up to standard" often means making an on-balance judgment. The developmental nature of conceptual understanding makes it difficult to specify in more than general terms the qualities that need to be pre sent in a piece of work for it to be judged as being up to standard for the grade level. These expectations are being defined concept by concept.

Commentaries are qualified by comments about further evidence needed.

Commentaries on work samples that illustrate these standards are qualified by comments about further evidence needed to demonstrate meeting the standard.

See, for example, "Buoyancy" on page 50 and "Light Reflection" on page 51.

Standards that describe skills and tools.

The third kind of standard is characterized by English Language Arts Standard 3, Conventions, Grammar, and Usage of the English Language. It is made up of the standards that describe skills and tools, such as analytical skills.

Standards that fit this category generally are:
English Language Arts Standards 3 and 4;
Mathematics Standards 5, 6, and 7;
Science Standards 5, 6, and 7;
Applied Learning Standards 3 and 4.

What distinguishes these standards from the other kinds is the body of evidence needed to demonstrate that the standard has been met. In some cases it is possible that a single piece of work could provide evidence of all of the features required to meet the standard; this is so for the standard for Conventions, Grammar, and Usage of the English Language, for example. But it would be rare for a single piece of work to constitute sufficient evidence for meeting the standard. Here, sufficiency refers not only to the idea of coverage but also to a notion of consistency of application. We want to be confident that the work in question is representative of a body of work.

Ideally, work that provides evidence for these standards also provides evidence for other standards.

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Commentaries are qualified by comments about further evidence needed.

Commentaries on work samples that illustrate these standards are qualified by comments about further evidence needed to demonstrate meeting the standard.

See, for example, "Points and Segments" on page 36.

The collection of work samples is not complete.

In no case is the current collection of work samples adequate for the purpose of illustrating the performance standards.

Nor is the current collection of work samples yet adequate for the purpose of displaying a sufficient range of the ways in which students might produce work that illustrates the standards. We are making a deliberate effort to ensure that the overall collection of work samples is drawn from a diverse range of students. Given the role of the work samples in helping to articulate the meaning of the standards, it is critical that their content reflects the diversity of the cultures and experiences of the students for whom the standards are intended.

It is possible that, as the collection of work samples proceeds, some of the work samples currently included will be discarded in favor of others.

Some standards cannot be illustrated by written work samples.

Some standards are not illustrated here because they cannot be illustrated by written work samples. Obvious examples of these standards are English Language Arts Standard 3, Speaking, Listening, and Viewing and the oral presentation parts of Applied Learning Standard 2, Communication Tools and Techniques.

We are in the process of collecting samples of performances on videotape and will produce a videotape to complement this book containing work samples and commentaries focusing on oral work and other performances.

Overview of the Performance Standards

English Language Arts

1. Reading
2. Writing
3. Speaking, Listening, and Viewing
4. Conventions, Grammar, and Usage of the English Language
5. Literature

Mathematics

1. Number and Operation Concepts
2. Geometry and Measurement Concepts
3. Function and Algebra Concepts
4. Statistics and Probability Concepts
5. Problem Solving and Mathematical Reasoning
6. Mathematical Skills and Tools
7. Mathematical Communication
8. Putting Mathematics to Work

Science

1. Physical Sciences Concepts
2. Life Sciences Concepts
3. Earth and Space Sciences Concepts
4. Scientific Connections and Applications
5. Scientific Thinking
6. Scientific Tools and Technologies
7. Scientific Communication
8. Scientific Investigation

Applied Learning

1. Problem Solving
2. Communication Tools and Techniques
3. Information Technology Tools and Techniques
4. Learning and Self-management Tools and Techniques
5. Tools and Techniques for Working With Others

The middle school standards are set at a level of performance approximately equivalent to the end of eighth grade. It is expected that some students might achieve this level earlier and others later than this grade.

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PERFORMANCE DESCRIPTIONS, WORK SAMPLES & COMMENTARIES

English Language Arts

Mathematics

Science

Applied Learning

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The reading requirement assumes an adequate library of appropriate reading material. In some places, library resources are too meager to support the amount of reading required for every student to achieve this standard. Where a shortage of books exists, better use of out-of-school resources must be made; for example, students may have to be assured access to local or county libraries.

Reading twenty-five books a year entails a substantial amount of time. Students may use materials read in conjunction with their regular class work, including courses other than English, to satisfy this requirement.

Reading "in depth" is intended to encourage students to invest themselves thoroughly in an area that interests them. Such an investment will generate reading from an array of resources, giving students more experience of reading as well as increased understanding of a subject. It is not intended to be some cursory experience of doing research on a topic which often requires little more than scanning materials, copying directly from references, and inserting transitional phrases and paragraphs. The challenge with the depth requirement is to encourage instead a complex understanding developed and enhanced through reading.

Much writing can be classified as belonging to the public arena. New Standards, however, defines public documents to mean only those pieces of text that are concerned with public policy, that address controversial issues confronting the public, or that arise in response to controversial issues or public policy. At the middle school level, the issues students write about come primarily from the school or local community.

Functional writing is writing that exists in order to get things done. Functional writing is ordinarily considered technical writing and, as such, is often not part of the typical English curriculum. New Standards requires students to demonstrate proficiency with functional writing because such writing is of increasing importance to the complex literacy of our culture.

1. Reading

Reading is a process which includes demonstrating comprehension; analyzing and interpreting printed texts; making connections between parts of a text, among several texts, and between texts and other experiences in and out of school; making extensions and applications of a text; evaluating texts; generalizing beyond the text to a broader sample or concept; and identifying the textual structure and/or the rhetorical function of a text. (Note that "comprehension" means basic understanding, i.e., getting the gist of a text.)

The student reads and comprehends material of the quality and complexity illustrated in the sample reading list equivalent to twenty-five books each year. The materials should include traditional and contemporary literature or the equivalent in magazines, newspapers, textbooks, and media, from at least three different literary genres and from at least five different writers. The student produces evidence of reading that:

- **demonstrates a thorough understanding of the text as a whole;**
- **identifies complexities presented in the text, i.e., ideas, information, levels of meaning;**
- **extracts salient information from the text;**
- **uses paraphrasing judiciously.**

Examples of producing evidence of reading include:

- maintaining annotated lists of works read;
- generating reading logs or journals;
- participating in formal and informal book talks.

The student reads in depth at least four books (or book equivalents) about one issue or subject, or four books by a single writer, or four books in one genre, and produces evidence of reading that:

- **makes and supports warranted and responsible assertions about the texts;**
- **supports assertions with elaborated and convincing evidence;**
- **makes perceptive and well developed connections;**
- **evaluates writing strategies and elements of the author's craft.**

Examples of producing evidence of reading in depth include:

- constructing book reviews;
- producing literary response papers;
- producing research reports;
- participating in formal or informal book talks.

The student reads informational materials to develop understanding and expertise and produces written or oral work that:

- **restates or summarizes information;**
- **relates new information to prior knowledge and experience;**
- **extends ideas;**
- **makes connections to related topics or information.**

Examples of producing evidence of reading informational materials include:

- using information to support or enhance a project;
- writing a report of information that draws from at least two sources;
- incorporating expert opinions into a speech or position paper;
- developing a proposal based on data obtained from reading informational texts.

The student demonstrates familiarity with a variety of public documents and produces written or oral work that:

- **identifies the author's purpose and stance;**
- **analyzes the arguments and positions advanced and the evidence offered in support of them;**
- **identifies common persuasive techniques.**

Examples of producing evidence of familiarity with public documents include:

- summarizing and critiquing two or more local newspaper articles related to the same topic or issue;
- responding to a public address made by an adult, e.g., the principal, a PTA/PTO officer, a visiting author;
- explaining to someone who has never heard of it a local document, such as a school related directive, a community related brochure, or an informational pamphlet;
- writing a letter to the editor in response to an editorial or to an article of local or national importance.

The student demonstrates familiarity with a variety of functional documents and produces written or oral work that:

- **identifies the sequence of activities needed to carry out a procedure;**
- **analyzes the formatting techniques used to make a document user-friendly;**
- **identifies any information that is either extraneous or missing.**

Examples of producing evidence of familiarity with functional documents include:

- writing a memo or conducting a briefing on procedures to be followed in a given situation;
- preparing a brochure for an upcoming school event;
- revising a set of poorly written instructions.

SAMPLE READING LIST

Sample reading list from which students and teachers could select. This list is not exclusive. Acceptable titles also appear on lists produced by organizations such as the National Council of Teachers of English and the American Library Association. Substitutions might also be made from lists approved locally.

Fiction

Anaya, *Bless Me, Ultima;*
Armstrong, *Sounder;*
Bonham, *Durango Street;*
Cohen, *Tell Us Your Secret;*
Collier, *My Brother Sam Is Dead;*
Cormier, *I Am the Cheese;*
Danziger, *The Cat Ate My Gymsuit;*
Fast, *April Morning;*
Gaines, *A Gathering of Old Men;*
Goldman, *The Princess Bride;*
Greene, *Summer of My German Soldier;*
Hansen, *Which Way Freedom;*
Hinton, *The Outsiders;*
Holman, *Slake's Limbo;*
London, *The Call of the Wild;*
Mathis, *Listen for the Fig Tree;*
Mohr, *Nilda;*
Neufeld, *Lisa, Bright and Dark;*
O'Brien, *Z for Zachariah;*
Reiss, *The Upstairs Room;*
Schaefer, *Shane;*
Stevenson, *Treasure Island;*
Voigt, *Dicey's Song;*
Walker, *To Hell With Dying;*
Walter, *Because We Are;*
Zindel, *The Pigman.*

Non-Fiction

Amory, *The Cat Who Came for Christmas;*
Berck, *No Place to Be: Voices of Homeless Children;*
Frank, *The Diary of a Young Girl;*
George, *The Talking Earth;*
Gilbreth, *Cheaper by the Dozen;*
Haskins, *Outward Dreams;*
Hautzig, *Endless Steppe: A Girl in Exile;*
Herriott, *All Creatures Great and Small;*
Lester, *To Be a Slave;*
Meyers, *Pearson, a Harbor Seal Pup;*
Soto, *Living Up the Street;*
White, *Ryan White: My Own Story;*
Yates, *Amos Fortune, Free Man.*

Poetry

Adams, *Poetry of Earth and Sky;*
Eliot, *Old Possum's Book of Practical Cats;*
Frost, *You Come Too;*
Greenfield, *Night on Neighborhood Street;*
Livingston, *Cat Poems.*

Drama

Blinn, *Brian's Song;*
Davis, *Escape to Freedom;*
Gibson, *The Miracle Worker;*
Lawrence and Lee, *Inherit the Wind;*
Osborn, *On Borrowed Time;*
Shakespeare, *A Midsummer Night's Dream;*
Stone, *Metamora, or, the Last of the Wampanoags.*

Folklore/Mythology

Blair, *Tall Tale America;*
Bruchac, *The First Strawberries: A Cherokee Story;*
Bryan, *Beat the Story-Drum, Pum-Pum;*
D'Aulaire, *Norse Gods and Giants;*
Gallico, *The Snow Goose;*
Lee, *Toad Is the Uncle of Heaven: A Vietnamese Folk Tale;*
Pyle, *Merry Adventures of Robin Hood.*

Modern Fantasy and Science Fiction

Bradbury, *Dandelion Wine;*
Babbitt, *Tuck Everlasting;*
Cooper, *The Grey King;*
Hamilton, *The Magical Adventures of Pretty Pearl;*
L'Engle, *A Wrinkle in Time;*
Tolkien, *The Hobbit;*
Yep, *Dragon of the Lost Sea.*

Magazines/Periodicals

Scope (Scholastic);
World (National Geographic);
Junior Scholastic (Scholastic);
Science World (Scholastic);
Cobblestone (American history);
Calliope (world history);
Faces (anthropology);
Odyssey (science).

Other:

Computer manuals; instructions; contracts. See also the reading lists included in award books corresponding to reading provided by the Girl Scouts of America and the Boy Scouts of America.

2. Writing

Writing is a process through which a writer shapes language to communicate effectively in terms of purposes, audiences, and contexts.

The student produces five types of writing.

A report, in which the writer:

- **engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;**
- **develops a controlling idea that conveys a perspective on the subject;**
- **creates an organizing structure appropriate to purpose, audience, and context;**
- **includes appropriate facts and details;**
- **excludes extraneous and inappropriate information;**
- **uses a range of appropriate strategies, such as providing facts and details, describing or analyzing the subject, narrating a relevant anecdote, comparing and contrasting, naming, and explaining benefits or limitations.**

Examples of reports include:

- an I-search essay;
- a saturation report;
- a report produced as part of studies in subjects such as Science, Social Studies, and Mathematics (*see also Mathematics Standard 7, Science Standard 7*).

A response to literature, in which the writer:

- **engages the reader through establishing a context, creating a persona, and otherwise developing reader interest;**
- **advances a judgment that is interpretive, analytic, evaluative, or reflective;**
- **supports a judgment through references to the text, references to other works, authors, or non-print media, or references to personal knowledge;**
- **demonstrates an understanding of the literary work;**
- **anticipates and answers a reader's questions.**

Examples of responses to literature include:

- a literary analysis;
- a book or movie review;
- a literary response paper;
- a comparison of a piece of literature with its media presentation.

A narrative account (fictional or autobiographical), in which the writer:

- **engages the reader by establishing a context, creating a point of view, and otherwise developing reader interest;**
- **establishes a situation, plot, point of view, setting, and conflict (and for autobiography, the significance of events and of conclusions that can be drawn from those events);**
- **creates an organizing structure;**
- **includes sensory details and concrete language to develop plot and character;**
- **excludes extraneous details and inconsistencies;**
- **develops complex characters;**
- **uses a range of appropriate strategies, such as dialogue, tension or suspense, naming, and specific narrative action, e.g., movement, gestures, expressions.**

(Writing Performance Description continued on next page)

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3. Speaking, Listening, and Viewing

(continued)

Examples of narrative accounts include:
- a biographical account;
- a fiction or non-fiction story;
- a personal narrative;
- a historical account *(see also Applied Learning Standard 1)*;
- a detailed travel diary;
- a news account of an event, fiction or non-fiction.

A narrative procedure, in which the writer:
- **engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;**
- **provides a guide to action for a relatively complicated procedure in order to anticipate a reader's needs; creates expectations through predictable structures, e.g., headings; and provides smooth transitions between steps;**
- **makes use of appropriate writing strategies, such as creating a visual hierarchy and using white space and graphics as appropriate;**
- **includes relevant information;**
- **excludes extraneous information;**
- **anticipates problems, mistakes, and misunderstandings that might arise for the reader.**

Examples of narrative procedures include:
- a set of rules for organizing a class meeting;
- a set of instructions for playing computer games;
- a set of instructions for using media technology;
- an explanation of a mathematical procedure *(see also Mathematics Standard 7)*;
- a project manual.

A persuasive essay, in which the writer:
- **engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;**
- **develops a controlling idea that makes a clear and knowledgeable judgment;**
- **creates an organizing structure that is appropriate to the needs, values, and interests of a specified audience, and arranges details, reasons, examples, and anecdotes effectively and persuasively;**
- **includes appropriate information and arguments and excludes information and arguments that are irrelevant;**
- **anticipates and addresses reader concerns and counter arguments;**
- **supports arguments with detailed evidence, citing sources of information as appropriate.**

Examples of persuasive essays include:
- a position paper;
- a problem-solution paper;
- an evaluation of a product or policy;
- an editorial on a current issue that uses reasoned arguments to support an opinion;
- a speech for a candidate running for school or public office.

The student accesses and exchanges information; that is, the student:
- **asks appropriate questions;**
- **responds to the questions of others;**
- **paraphrases and summarizes to increase understanding;**
- **listens responsively to others' points of view;**
- **uses language which is simple and appropriate for communicating;**
- **speaks audibly;**
- **makes appropriate eye contact;**
- **respects turn taking of other speakers;**
- **uses language and gestures expressively and persuasively;**
- **shows awareness of an audience by adjusting to its reaction.**

Examples of accessing and exchanging information include:
- participating in peer tutoring sessions;
- responding when interviewed about a recent book preference;
- planning and conducting interviews;
- justifying and elaborating upon a point of view;
- participating in a panel discussion and representing a point of view regarding an issue of local importance;
- participating in a mock trial;
- making a formal presentation;
- presenting a portfolio to an individual or panel and discussing strengths and weaknesses of the portfolio contents;
- participating in response groups as part of the writing process.

The student responds to oral presentations; that is, the student:
- **asks appropriate questions;**
- **paraphrases and summarizes to increase understanding;**
- **speaks audibly;**
- **uses language and gestures expressively and persuasively.**

Examples of responding to oral presentations include:
- analyzing a performer's stance toward a character in a film or play;
- judging a debate;
- using a rubric to evaluate a presentation;
- asking a question and a follow up question following a presentation.

The student makes informed judgments about television, radio, and film productions; that is, the student:
- **articulates reasoned judgments for selecting particular television and radio productions and rejecting others;**
- **recounts the story elements of television, radio, and film productions;**
- **identifies the intended messages of advertisements, entertainment programs, and news programs;**
- **identifies common persuasive techniques used in advertising;**
- **describes ways used to portray and comment on the general culture.**

Examples of making informed judgments about television, radio, and film productions include:
- presenting a coherent retelling of an episode of a television production;
- presenting an analysis of a television or radio commercial for an imaginary product;
- identifying the turning point in the action of a film;
- identifying recurring plots or sub-plots in a specific television genre, e.g., courtroom drama, murder mystery;
- distinguishing between fact and opinion in "infomercials";
- identifying stereotypes in fictional characters.

4. Conventions, Grammar, and Usage of the English Language

The student independently uses appropriate conventions of the English language, including:
- **spelling;**
- **sentence construction;**
- **paragraph structure;**
- **punctuation;**
- **grammar;**
- **usage.**

Examples of using appropriate conventions include:
- demonstrating in a piece of writing the ability to manage the conventions, grammar, and usage of English so that they aid rather than interfere with reading;
- proofreading acceptably the student's own writing or the writing of others, using dictionaries and other resources, including the teacher or peers as appropriate;
- observing conventions of language during formal oral presentations;
- revising a piece of writing by combining sentences.

The student analyzes and revises written work, as appropriate, relative to audiences and purposes by:
- **adding or deleting details;**
- **adding or deleting explanations;**
- **clarifying difficult passages;**
- **rearranging words, sentences, and paragraphs to improve or clarify meaning;**
- **sharpening the focus;**
- **reconsidering the organizational structure.**

Examples of analyzing and revising written work include:
- incorporating into revised drafts, as appropriate, suggestions taken from critiques made by peers and teachers;
- producing a series of distinctly different drafts that result in a polished piece of writing;
- critiquing the writing of a peer;
- describing the reasons for stylistic choices made as a writer.

5. Literature

The student responds to fiction, non-fiction, poetry, and drama using interpretive, critical, and evaluative processes; that is, the student does one or more of the following in oral or written presentations:
- **analyzes the reasons for a character's actions, taking into account the situation and basic motivation of the character;**
- **identifies recurring themes across works;**
- **identifies stereotypical characters as opposed to fully developed characters;**
- **makes inferences and draws conclusions about context, events, characters, setting, and theme;**
- **identifies the effect of literary devices such as figurative language, allusion, diction, dialogue, and description;**
- **interprets the impact of authors' decisions regarding word choice, content, and literary elements;**
- **identifies the characteristics of literary forms and genres;**
- **evaluates literary merit;**
- **identifies the effect of point of view.**

Examples of responding to literature include:
- analyzing stereotypical characters in a popular television production;
- examining themes in the work of one popular young-adult author;
- evaluating the effect of literary devices in a number of poems by one author or poems on a common topic;
- comparing the literary merits of two or more short stories, biographies of one individual, novels, or plays;
- writing and/or performing a skit *(see also Applied Learning Standard 1)*;
- making a parody;
- speculating about point of view in a novel read by the class.

The student demonstrates proficiency in at least one literary genre.

Examples of literary genres include:
- a personal essay;
- a short story;
- a short play *(see also Applied Learning Standard 1)*;
- poetry, e.g., free verse and rhymed;
- a vignette.

Samples of student work that help explain "how good is good enough" for these standards can be found immediately following these pages.

To see how these performance descriptions compare with the expectations for elementary school and high school, turn to pages 76-81.

The "response to literature" in the Writing standard is meant to replace the more typical literary analysis paper that many students routinely produce in conjunction with literature study. This does not preclude literary analysis but instead opens up possibilities for reader response as well.

These standards allow for oral performances of student work whenever appropriate.

It is not intended that all student work developed to meet the English Language Arts standards should necessarily come from an English class. The challenge is to ensure that Mathematics, Science, and Applied Learning work samples are incorporated widely into the English Language Arts work samples, thus encouraging students to use work from other classes while not weakening the English curriculum.

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Work Sample & Commentary: *Miss Sadie*

1	2	3	4	5
Reading	**Writing**	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Mathematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	Scientific Connections & Applications	Scientific Thinking	Scientific Tools & Technologies	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

English Language Arts required by the task

Students were asked to present a special person to readers who do not know the person. They could present the person through details of appearance and manner, descriptions of working or living environment, and habits or typical activities. In addition, students were to reveal the personal quality of their relationship with the person presented.

Circumstances of performance

✓	timed assignment
	extended project
	opportunity for revision
✓	first draft
	revised draft
	teacher generated topic
✓	student generated topic
	embedded in class work
	research required

This work sample provides evidence for the quality of work expected for the following part of the English Language Arts standards:

Standard 2, Writing—produces a narrative account.

Writing

The student produces:

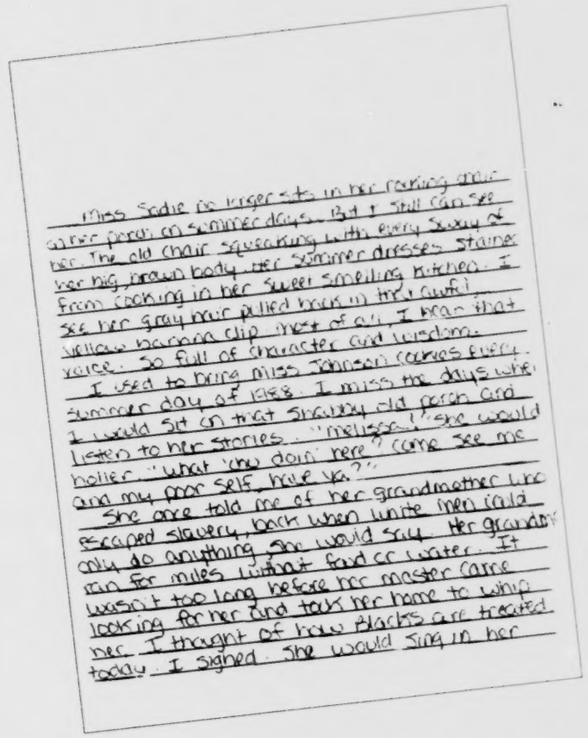
A narrative account (fictional or autobiographical), in which the writer:

- **engages the reader by establishing a context, creating a point of view, and otherwise developing reader interest;**
- **establishes a situation, plot, point of view, setting, and conflict (and for autobiography, the significance of events and of conclusions that can be drawn from those events);**
- **creates an organizing structure;**
- **includes sensory details and concrete language to develop plot and character;**
- **excludes extraneous details and inconsistencies;**
- **develops complex characters;**
- **uses a range of appropriate strategies, such as dialogue, tension or suspense, naming, and specific narrative action, e.g., movement, gestures, expressions.**

This work provides evidence that the student:

- clearly engages the reader's interest with a vivid beginning that raises a question about why Miss Sadie is not in her rocking chair even though the narrator claims she can still see her;
- further engages the reader by creating a persona that clearly can handle an emotional issue, that is, the loss of a valued friend, without becoming overly sentimental;
- establishes the significance of the events of the summer, e.g., "I learned that I could be friends with someone generations apart from my own";
- uses a wide range of strategies to present the character of Miss Sadie, including: vivid imagery, e.g., "The old chair squeaking with every sway of her big, brown body"; dialect, e.g., "What 'chu doin' here?"; actions such as accounts of ancestors, e.g., grandmother's escape from slavery and subsequent recapture and hymns passed down from ancestors; and the ability to understand and forgive rude behavior, e.g., the incident involving Jimmy Taylor;
- creates an organizing structure by effectively completing the circle begun in the first paragraph: from "Miss Sadie no longer sits in her rocking chair on her porch on summer days. But I still can see her" to "Because Miss Sadie no longer sits in her rocking chair on her porch on summer days. I'm glad that I can still see her."

Errors in this first draft may be attributed to the nature of the task, which was given in a timed writing situation. The writing was completed in forty-five minutes with no opportunities for review and revision. The spelling and grammatical errors in the work sample do not detract from the overall quality of the work.



Miss Sadie no longer sits in her rocking chair
on her porch on summer days. But I still can see
her. The old chair squeaking with every sway of
her big, brown body. Her summer dresses stained
from cooking in her sweet smelling kitchen. I
see her gray hair pulled back in the usual
yellow bandana clip. Most of all, I hear that
voice. So full of character and wisdom.
voice. So full of character and wisdom.
I used to hate Miss Johnson. Cookies every
summer day of 1988. I miss the days when
I would sit on that squeaky old person and
listen to her stories. "Melissa!" she would
holler "what 'chu doin' here?" Come see me
and my poor self have ya?"
She once told me of her grandmother who
escaped slavery back when white men could
only do anything she would say. Her grandma
ran for miles without food or water. It
wasn't too long before her master came
looking for her and took her home to whip
her. I thought of how blacks are treated
today. I sighed. She would sing in her

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soulful, bearing voice, old negro hymns passed down from her mother and grandmother. I would sit there in amazement.

Once, Tommy Taylor came walking by us yelling, "Melissa! What'cha doin' with that old, fat, Black lady, anyways?"

Before I could retaliate Miss Johnson said to me, "Now you mustn't. We must feel sorry for that terrible child. His mother must have done gone and not taught him no manners!" She actually wanted me to bow my head and pray for him. (Even though I went to his house and punched him at the next day.)

My friends would tease me for spending the whole summer with Sadie Johnson, "The Widow of Connecticut," they called her. But I'm so very glad I did. She taught me then, to not care what other people thought. I learned that I could be friends with someone generations apart from my own.

My visits became less frequent when school started. I had other things to think about. Boys, clothes, grades. You know, real important stuff.

One day I was thinking, I haven't seen Miss Sadie in a while. So after school I trotted up to her house amidst the twirling, autumn leaves.

I rang her bell. The door cracked open and the woman adjusted her glasses. "May I help you?"

"Miss Sadie, it's me, Melissa."

"I-I" she stuttered. "I don't remember," She said and shut the door. I heard crying. I rang the door again and she screamed, "Please, leave!" in a scared, confused voice.

I went home, bewildered and my mother told me to stop bothering Miss Sadie. I said I wasn't bothering her. Mama said, "Miss Johnson has a disease. Alzheimer's disease. It makes her forget things, people, family even. And so, I don't want you over there anymore, you hear?"

Then, I didn't realize or comprehend, how someone so special to you could forget your own existence when you'd shared a summer so special and vivid in your mind.

That Christmas I went to bring Miss Johnson cookies. She wasn't there. I learned from a family member that she was in the hospital and that she'd die very soon. As the woman, a daughter maybe, spoke, my heart broke.

"Well, you make sure she gets these cookies," I said, my voice cracking and tears welling in my eyes.

Today, I've learned to love old people. For their innocence, for their knowledge. I've learned to always treat people with kindness, no matter how cruel they may seem. But mainly I've learned, that you must cherish the time spent with a person. And memories are very valuable. Because Miss Sadie no longer sits in her rocking chair on her porch on summer days. I'm glad that I can still see her.

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Japanese teachers "give instruction on the following in order for students to acquire the ability to express themselves in the Japanese language: selection of the proper topics and materials in relation to the purpose or situation, and deepening of their thoughts on the items to be expressed; deepening of one's own thoughts and expression of the theme or main point accurately; devising procedures to explain based on a solid foundation; consideration of the composition according to the basic ideas, using concrete materials, and development of the whole structure while devising the composition; devising word usage with consideration of the purpose or effect of expression."

Course of Study for Lower Secondary Schools in Japan, p. 10.

Work Sample & Commentary: *Outsider...*

1	2	3	4	5
Reading	**Writing**	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Mathematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	Scientific Connections & Applications	Scientific Thinking	Scientific Tools & Technologies	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

English Language Arts required by the task

Students were asked to tell a story, creating a fictional world in which the elements of setting, character, and incident comprised a coherent narrative structure. Students were asked to establish the story situation by placing the characters in a believable context through narrative strategies such as dialogue, the use of sensory details, and pacing. In addition, they were asked to bring the stories to logical, satisfying resolutions.

Circumstances of performance

✓	timed assignment
	extended project
	opportunity for revision
✓	first draft
	revised draft
	teacher generated topic
✓	student generated topic
	embedded in class work
	research required

This work sample provides evidence for the quality of work expected for the following part of the English Language Arts standards:

Standard 2, Writing—produces a narrative account.

Writing

The student produces:

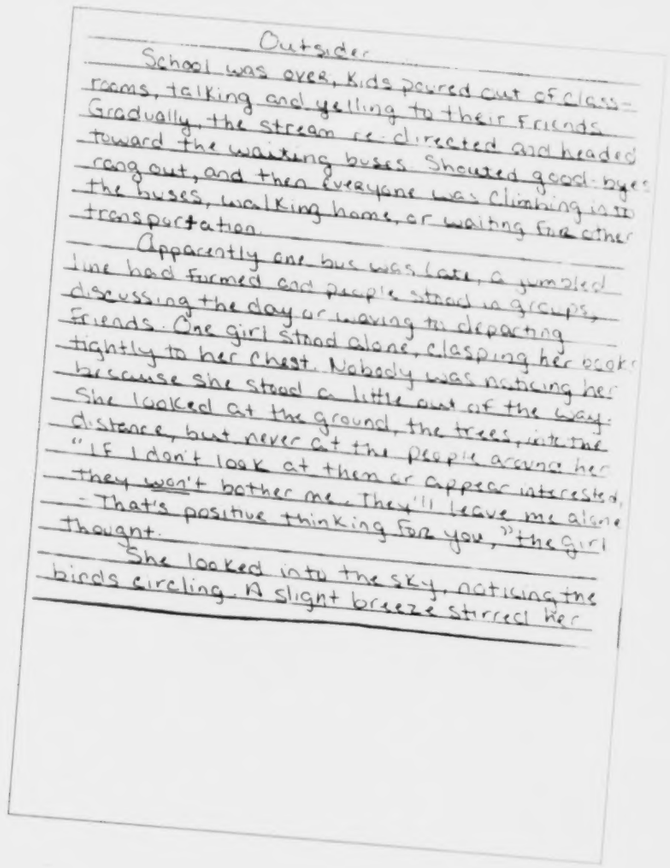
A narrative account (fictional or autobiographical), in which the writer:

- **engages the reader by establishing a context, creating a point of view, and otherwise developing reader interest;**
- **establishes a situation, plot, point of view, setting, and conflict (and for autobiography, the significance of events and of conclusions that can be drawn from those events);**
- **creates an organizing structure;**
- **includes sensory details and concrete language to develop plot and character;**
- **excludes extraneous details and inconsistencies;**
- **develops complex characters;**
- **uses a range of appropriate strategies, such as dialogue, tension or suspense, naming, and specific narrative action, e.g., movement, gestures, expressions.**

This work provides evidence that the student:

- engages the reader, by quickly drawing the reader into the fictional yet realistic teenage world of Carla;
- establishes the following: a situation (Carla is shy and insecure); a setting; and conflict (shy Carla versus the girl "with a discontented face" and "loud, raucous laughter");
- creates an organizing structure based on a symbol: "She looked into the sky, noticing the birds circling" and "Carla clambered over the girl, a feeling of elation mounting in her. 'I wanted the window anyway,' she thought. 'I want to watch the birds'";
- includes sensory details and concrete language to develop plot and character: "the stream re-directed and headed toward…"; "a jumbled line"; "a girl with a discontented face"; "Carla felt her heart dip into her stomach where it got lost amoung [sic] the butterflies"; "Carla's books fell to the ground, splashing papers and pens all over";
- develops in Carla a complex character whose shyness and insecurity are revealed to the reader by her actions: "She looked at the ground, the trees, into the distance, but never at the people around her"; by her thoughts: "'If I don't look at them or appear interested, they won't bother me'"; by the reactions of others: "Everyone was…looking at her beligerently [sic]"; and by her speech: "Clearing her throat, she murmured, 'I'm a Freshman'";
- uses appropriate strategies of short story writing: dialogue and interior monologue; suspense, e.g., Carla's final encounter with the antagonist; the development of a significant change in the protagonist's character, e.g., Carla's mustering of courage to speak up for herself.

Errors in this first draft may be attributed to the nature of the task, which was given in a timed writing situation. The writing was completed in forty-five minutes with no opportunities for review and revision. The spelling and grammatical errors in the work sample do not detract from the overall quality of the work.



Outsider

School was over. Kids poured out of classrooms, talking and yelling to their friends. Gradually, the stream re-directed and headed toward the waiting buses. Shouted good-byes rang out, and then everyone was climbing on the busses, walking home, or waiting for other transportation.

Apparently one bus was late, a jumbled line had formed and people stood in groups, discussing the day or waving to departing friends. One girl stood alone, clasping her books tightly to her chest. Nobody was noticing her because she stood a little out of the way. She looked at the ground, the trees, into the distance, but never at the people around her. "If I don't look at them or appear interested, they won't bother me. They'll leave me alone. That's positive thinking for you," the girl thought.

She looked into the sky, noticing the birds circling. A slight breeze stirred her

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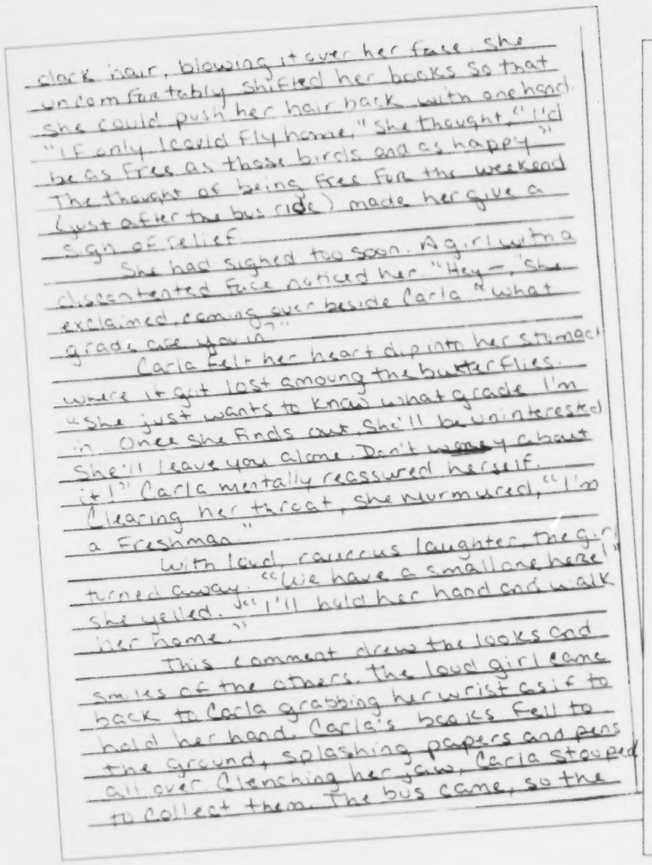


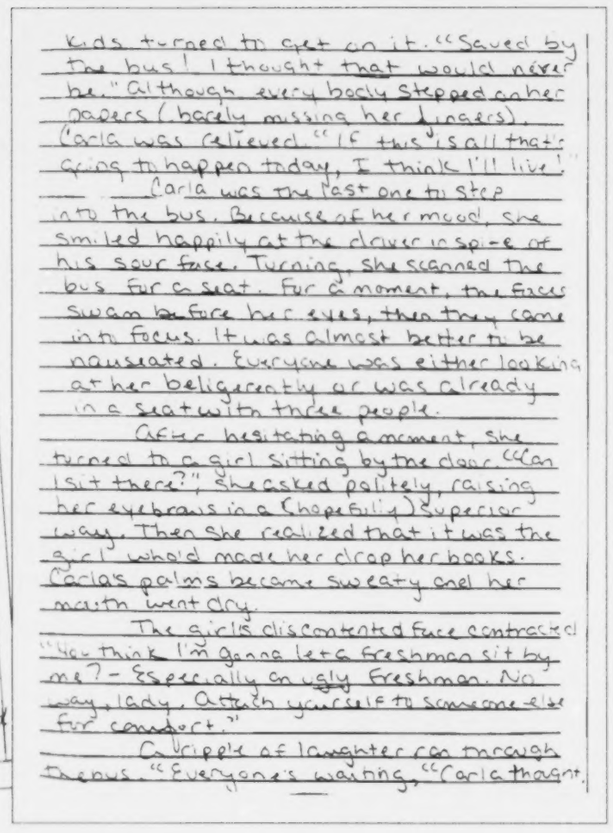
dark hair, blowing it over her face. She uncomfortably shifted her books so that she could push her hair back with one hand. "If only I could fly home," she thought, "I'd be as free as those birds and as happy." The thought of being free for the weekend (just after the bus ride) made her give a sigh of relief.

She had sighed too soon. A girl with a discontented face noticed her. "Hey—," she exclaimed, coming over beside Carla "what grade are you in"

Carla felt her heart drop into her stomach, where it got lost among the butterflies. "She just wants to know what grade I'm in. Once she finds out she'll be uninterested. She'll leave you alone. Don't worry about it!" Carla mentally reassured herself. Clearing her throat, she murmured, "I'm a Freshman."

With loud, raucous laughter, the girl turned away. "We have a smallone here!" she yelled. "I'll hold her hand and walk her home."

This comment drew the looks and smiles of the others. The loud girl came back to Carla grabbing her wrist as if to hold her hand. Carla's books fell to the ground, splashing papers and pens all over. Clenching her jaw, Carla stooped to collect them. The bus came, so the



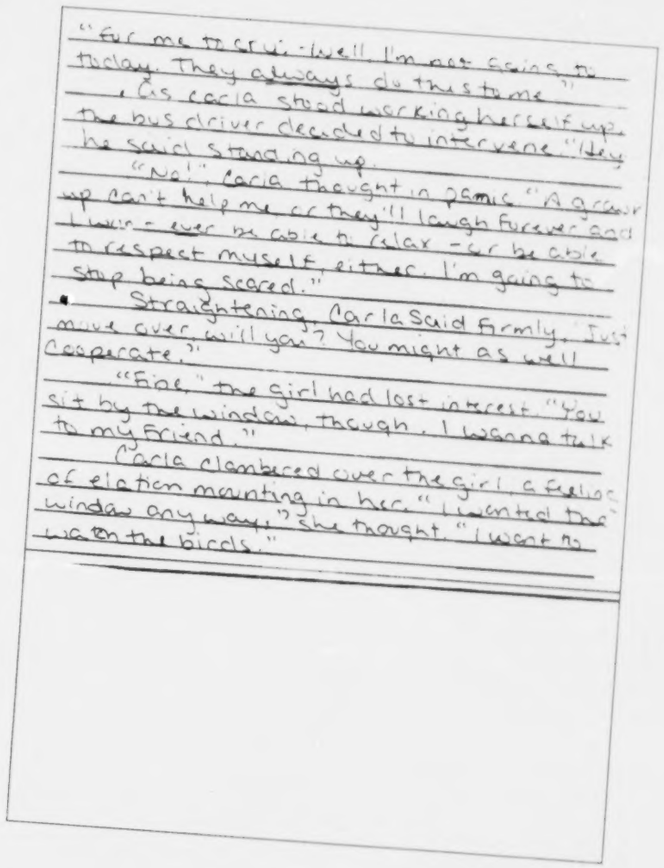
kids turned to get on it. "Saved by the bus! I thought that would never be." Although every body stepped on her papers (barely missing her fingers). Carla was relieved. "If this is all that's going to happen today, I think I'll live."

Carla was the last one to step into the bus. Because of her mood, she smiled happily at the driver in spite of his sour face. Turning, she scanned the bus for a seat. For a moment, the faces swam before her eyes, then they came in to focus. It was almost better to be nauseated. Everyone was either looking at her belligerently or was already in a seat with three people.

After hesitating a moment, she turned to a girl sitting by the door. "Can I sit there?" she asked politely, raising her eyebrows in a (hopefully) superior way. Then she realized that it was the girl who'd made her drop her books. Carla's palms became sweaty and her mouth went dry.

The girl's discontented face contracted. "You think I'm gonna let a Freshman sit by me? - Especially an ugly Freshman. No way, lady. Attach yourself to someone else for comfort."

Cripples of laughter ran through the bus. "Everyone's waiting," Carla thought.



"For me to cry. Well I'm not going to today. They always do this to me."

As Carla stood working herself up the bus driver decided to intervene. "Hey," he said standing up.

"No!" Carla thought in panic. "A grown up can't help me or they'll laugh forever and I won't ever be able to relax - or be able to respect myself, either. I'm going to stop being scared."

Straightening, Carla said firmly, "Just move over, will you? You might as well cooperate."

"Fine," the girl had lost interest. "You sit by the window, though. I wanna talk to my friend."

Carla clambered over the girl, a feeling of elation mounting in her. "I wanted that window anyway," she thought. "I want to watch the birds."

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The Scottish national curriculum for this level states that "new effects can be achieved by showing pupils how to turn basic story ideas into plays, radio, TV or film scripts, or by having the story told in role, for example by a news reader. This will help pupils to discover the need for a flexible and varied vocabulary. From their reading, pupils can be made aware of differences in effects created by first or third person narrative, and the effects possible with present and past tense narration."

Curriculum and Assessment in Scotland, National Guidelines: English Language 5-14, p. 47.

Work Sample & Commentary: *Using the Library Reference Computers*

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Mathematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	Scientific Connections & Applications	Scientific Thinking	Scientific Tools & Technologies	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

An extended project, here, is one that has occurred over a sustained period of time, generally at least one week, and often longer.

English Language Arts required by the task

Students were asked to write, for an audience of peers, a set of instructions for using something with which they were familiar.

Circumstances of performance

	timed assignment
✓	extended project
✓	opportunity for revision
	first draft
✓	revised draft
	teacher generated topic
✓	student generated topic
✓	embedded in class work
	research required

This work sample provides evidence for the quality of work expected for the following parts of the English Language Arts standards:

Standard 2, Writing—produces a narrative procedure;
Standard 4, Conventions, Grammar, and Usage of the English Language—uses appropriate conventions; analyzes and revises written work.

Writing

The student produces:

A narrative procedure, in which the writer:

- **engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;**
- **provides a guide to action for a relatively complicated procedure in order to anticipate a reader's needs, creates expectations through predictable structures, e.g., headings, and provides smooth transitions between steps;**
- **makes use of appropriate writing strategies such as creating a visual hierarchy and using white space and graphics as appropriate;**
- **includes relevant information;**
- **excludes extraneous information;**
- **anticipates problems, mistakes, and misunderstandings that might arise for the reader.**

This work provides evidence that the student:

- engages the reader by establishing a context of need, i.e., how to use reference computers to conduct research for school tasks;
- creates the persona of a helpful, non-critical guide who has personal knowledge of the procedure: "Usually the computer is already turned on for you" and "Say you are looking for *The Game*, a book by R. L. Stine";
- anticipates a reader's needs by describing what is on the computer screen and by explaining where to find the arrows that move the cursor, what the cursor looks like, and how to select a folder;
- uses white space and headings as guides to the procedure; provides transitions in the form of single words, e.g., "Then press enter"; and clauses, e.g., "After you choose…";
- includes information relevant to a particular type of computer in a specific library;
- excludes extraneous information;
- anticipates problems that the reader might encounter by providing a section of "Helpful Tips."

Conventions, Grammar, and Usage of the English Language

The student independently uses the appropriate conventions of the English language, including:

- **spelling;**
- **sentence construction;**
- **paragraph structure;**
- **punctuation;**
- **grammar;**
- **usage.**

This work provides evidence that the student manages the conventions of English through almost error free writing.

The student analyzes and revises written work, as appropriate, relative to audiences and purposes by:

- **adding or deleting details;**
- **adding or deleting explanations;**
- **clarifying difficult passages;**
- **rearranging words, sentences, and paragraphs to improve or clarify meaning;**
- **sharpening the focus;**
- **reconsidering the organizational structure.**

This work provides evidence that the student:

- adds information in the writing process, e.g., the early draft has one helpful tip while the final draft includes three tips;
- deletes selected passages, e.g., the section titled "How to use the Reference Computer" in the early draft is compressed into the last two sentences in the first section of the final draft;
- clarifies a number of passages, e.g., "The following directions will help you find your book" becomes "The following directions will help you find books after you have chosen a folder";
- sharpens the focus, e.g., the change of title from "Getting Started" to "Using the Library Reference Computer To Find Books For Your Research" makes the piece specific rather than general.

Final Draft

Using the Library Reference Computers To Find Books For Your Research

Usually the computer is already turned on for you. On the screen there is a big, light green rectangle that reads *inquired by* and *subject, author,* and *title* in that order. In the bottom right-hand corner there are four arrows that move the cursor or marker up, down, right, and left (exactly like the arrow points). The cursor is a bright blue line that highlights the title of the folder as you move the arrows. Use the up and down arrows to move the cursor to the folder you choose. Then press enter.

Working in Your Chosen Folder

The following directions will help you find books after you have chosen a folder:

Title

After you choose the Title folder, type the title of the book. If the book you are looking for is in the library, the screen will bring up the author's name, short summary, call number, number of pages, and tell you if it is available or not.
Example: Say you are looking for **The Game**, a book by **R. L. Stine.** Type the title and the screen will show you if the book is in our library and if it is available.

Author

After you choose the Author folder, type the author's name and the screen will show you all the books we have by that author. If you see the book you want in the list, move the

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cursor to that title and press enter. The screen will then show you a call number, a short summary, number of pages title, and subject.
Example: Say you are looking for a book by **Christopher Pike**, but you do not know the title. Type his name into the computer and the screen will show you all the books by him that are available in the library.

Subject

After you have chosen the Subject folder, type the subject that interests you. Look through the list of books under that subject (use the arrows to move through the list). If you find a book you want, press enter again and the screen will show you the call number, short summary, number of pages, title, and author's name.
Example: Say you are looking for Texas History. Type that in and the screen will show you a long list of different topics on that subject. Of course, you can narrow down your topic. The Alamo or Sam Houston or Ranching will have fewer entries than Texas History, but the entries will be more specific.

Helpful Tips

•To get out of a folder, press escape.

•If you get in a mess, just ask anyone in the library for help. You will not get in trouble since you are just learning and how else would you learn? Usually pressing escape several times will get you out of your mess and back to the first screen.

•If you cannot find books on your subject, try the magazine index. (There is a set of directions for that index also.)

Early Draft

Getting Started

Usually the computer is already turned on for you. On the screen there is a big, light green rectangle that says inquired by and subject, author, and title in that order. In the bottom right hand corner there are four arrows that go up, down, right, left use the up and down arrows to move the cursor to go to the folder you want. The cursor is bright blue line that high lights the title of the folder as you move the arrows.

How to use the Reference Computers

At the reference computer there are three different folders you can choose from (author, title and subject) to help you find the book you are looking for. The following directions will help you find your book:

Title
On the reference computer screen go to the folder that says "Inquired by Title" and press enter. Next type the title of the book into th computer. If we have the book you're looking for in our library it will give you the authors name, short summary, call number, number of pages, and tell you if it is available or not.
Example: Say your looking for **The Game** a book by **R.L. Stine.** Type the title and it will show you if the book is in our library and if it's available.

Author:
On the reference computer screen go to the folder that says "Inquire by Author" and press enter. After you do that, type the authors name and the screen will show you all the books we have by that author. If they have the book you want go to the title and press enter again. When you finish that, you will see on the screen call number, a short summary, number of pages, title, and subject.
Example: For instance say your looking for a book by **Christopher Pike,** but you don't know the title. Type his name into the computer and it will show you all the books we have by him in our library.

Subject
On the reference computer screen go to the folder that says "Inquired by Subject" and press enter. Next type the subject you are looking for. If it lists the book you want, press enter and it will show you all the books we have on that subject. If it has the book you want, press enter again and it will show you the call number, short summary, number of pages, title, and authors name.
Example: Say you're looking for the subject *Texas History*, it will show a long list of different topics on that subject.

A Helpful Tip
• To get out of a folder press the escape key (esc). In the upper left hand corner.

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1 Reading	**2 Writing**	3 Speaking, Listening & Viewing	4 Conventions, Grammar & Usage	5 Literature

English Language Arts

1 Number & Operation Concepts	2 Geometry & Measurement Concepts	3 Function & Algebra Concepts	4 Statistics & Probability Concepts	5 Problem Solving & Mathematical Reasoning	6 Mathematical Skills & Tools	7 Mathematical Communication	8 Putting Mathematics to Work

Mathematics

1 Physical Sciences Concepts	2 Life Sciences Concepts	3 Earth & Space Sciences Concepts	4 Scientific Connections & Applications	5 Scientific Thinking	6 Scientific Tools & Technologies	7 Scientific Communication	8 Scientific Investigation

Science

1 Problem Solving	2 Communication Tools & Techniques	3 Information Tech. Tools & Techniques	4 Learning & Self-mgmt. Tools & Techniques	5 Tools & Techniques for Working With Others

Applied Learning

English Language Arts required by the task

Students were asked to define or describe a problem and to argue for one or more solutions. Students were to establish the seriousness of the problem and to argue for their solution, giving reasons and countering opposing solutions.

Circumstances of performance

✓	timed assignment
	extended project
	opportunity for revision
✓	first draft
	revised draft
	teacher generated topic
✓	student generated topic
	embedded in class work
	research required

This piece of student work provides evidence for the quality of work expected for the following part of the English Language Arts standards:

Standard 2, Writing—produces a persuasive essay.

Writing

The student produces:

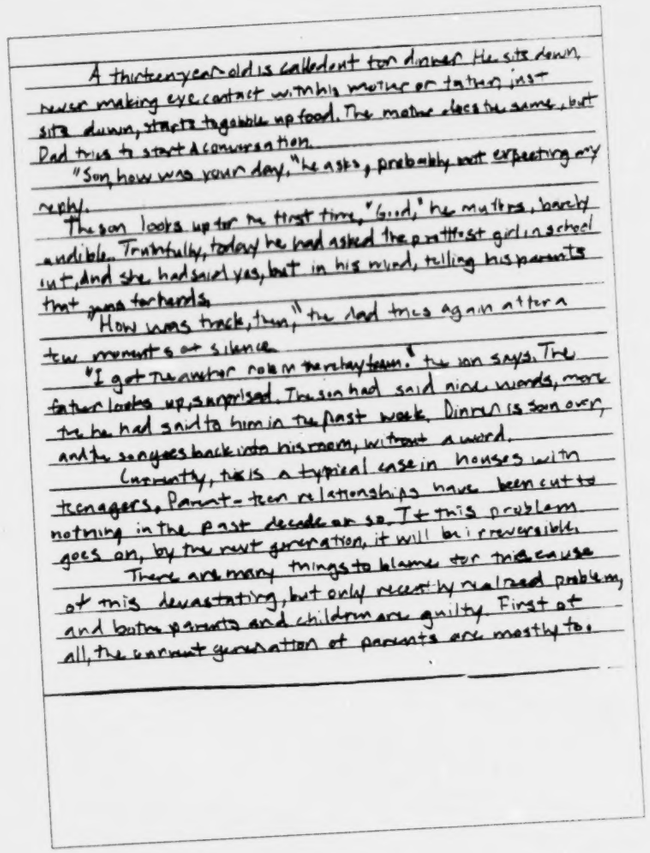
A persuasive essay, in which the writer:

- **engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;**
- **develops a controlling idea that makes a clear and knowledgeable judgment;**
- **creates and organizes a structure that is appropriate to the needs, values, and interests of a specified audience, and arranges details, reasons, examples, and anecdotes effectively and persuasively;**
- **includes appropriate information and arguments and excludes information and arguments that are irrelevant;**
- **anticipates and addresses reader concerns and counter arguments;**
- **supports arguments with detailed evidence, citing sources of information as appropriate.**

This work provides evidence that the student:

- engages reader interest by beginning with an effective scenario that identifies the problem being addressed: the failure of parent-child communications;
- creates a persona that is consistent throughout: a teenager who is familiar with the problem and who has considered its pervasiveness and seriousness and is now ready to offer a solution;
- excludes inappropriate information and arguments;
- anticipates reader concerns in response to his argument, by acknowledging that solutions are not apparent but offering acceptable alternatives: "Although no real solutions are apparent at the current time, logical answers can be used";
- supports arguments with convincing evidence: parents are too busy with weekend and work related activities; both parents work; "Nerds" are the only ones who talk to their parents; divorce affects teens; and by citing a popular authority figure, i.e., quoting Ann Landers directly in paragraph nine and paraphrasing her in paragraph ten.

Errors in this first draft may be attributed to the nature of the task, which was given in a timed writing situation. The writing was completed in forty-five minutes with no opportunities for review and revision. The spelling and grammatical errors in the work sample do not detract from the overall quality of the work.



A thirteen year old is called out for dinner. He sits down, never making eye contact with his mother or father, just sits down, starts to gobble up food. The mother does the same, but Dad tries to start a conversation.

"Son, how was your day," he asks, probably not expecting any reply.

The son looks up for the first time, "Good," he mutters, barely audible. Truthfully, today he had asked the prettiest girl in school out, and she had said yes, but in his mind, telling his parents that going for seconds.

"How was track, Tom," the dad tries again after a few moments of silence.

"I got the anchor role in the relay team," the son says. The father looks up, surprised. The son had said nice words, more than he had said to him in the past week. Dinner is soon over, and the son goes back into his room, without a word.

Currently, this is a typical case in houses with teenagers. Parent-teen relationships have been cut to nothing in the past decade or so. If this problem goes on, by the next generation, it will be irreversible.

There are many things to blame for this decrease of this devastating, but only recently realized problem, and both parents and children are guilty. First of all, the earliest generation of parents are mostly to-

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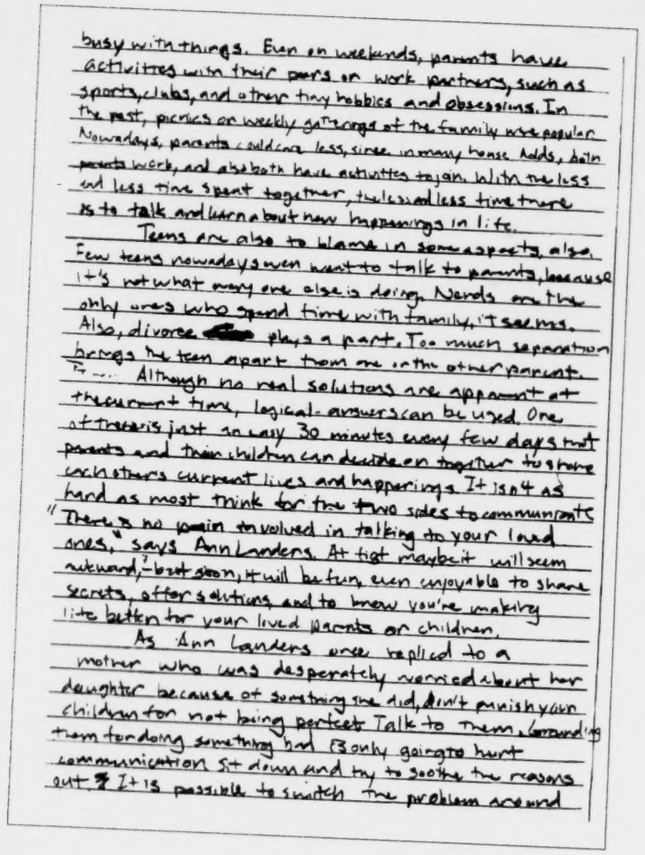

busy with things. Even on weekends, parents have activities with their peers or work partners, such as sports, clubs, and other tiny hobbies and obsessions. In the past, picnics or weekly gatherings of the family were popular. Nowadays, parents could care less, since in many house holds, both parents work, and also both have activities to go on. With the less and less time spent together, the less and less time there is to talk and learn about new happenings in life.

Teens are also to blame in some aspects, also. Few teens nowadays even want to talk to parents, because it's not what many over else is doing. Nerds are the only ones who spend time with family, it seems. Also, divorce [redacted] plays a part. Too much separation brings the teen apart from one or the other parent. ... Although no real solutions are apparent at the current time, logical answers can be used. One of these is just an easy 30 minutes every few days that parents and their children can decide on together to share each others current lives and happenings. It isn't as hard as most think for the two sides to communicate. "There is no pain involved in talking to your loved ones," says Ann Landers. At first maybe it will seem awkward, but soon, it will be fun, even enjoyable to share secrets, offer solutions and to know you're making life better for your loved parents or children.

As Ann Landers once replied to a mother who was desperately worried about her daughter because of something she did, don't punish your children for not being perfect. Talk to them, Communicating them for doing something bad [illegible] only going to hurt communication. Sit down and try to sooth the two reasons out. If it is possible to switch the problem around to become a force in improving the relationship. Mainly, the only real answer to the problem of communication is to try. Both sides must give it a try and sure enough, after awhile, talking to each other can be an outlet of emotions and can even prevent bad decisions because [redacted] someone has helped the other in discussing the problem. It is not an irreversible problem, [redacted] parents.

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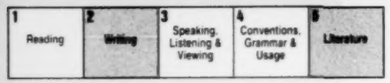
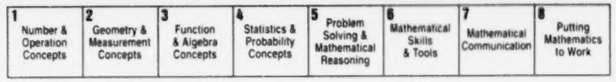
Japanese students are expected to receive instruction in how "to select proper topics and materials according to the purpose or situation and to deepen their thoughts on the items to be expressed; to devise procedures to explain a point, based on a solid foundation."

Course of Study for Lower Secondary Schools in Japan, p. 10.

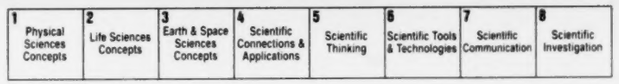
Work Sample & Commentary: *"Star Trek: The Next Generation": A Show for All Generations*



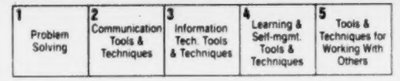
English Language Arts


1 Number & Operation Concepts
2 Geometry & Measurement Concepts
3 Function & Algebra Concepts
4 Statistics & Probability Concepts
5 Problem Solving & Mathematical Reasoning
6 Mathematical Skills & Tools
7 Mathematical Communication
8 Putting Mathematics to Work

Mathematics


1 Physical Sciences Concepts
2 Life Sciences Concepts
3 Earth & Space Sciences Concepts
4 Scientific Connections & Applications
5 Scientific Thinking
6 Scientific Tools & Technologies
7 Scientific Communication
8 Scientific Investigation

Science


1 Problem Solving
2 Communication Tools & Techniques
3 Information Tech. Tools & Techniques
4 Learning & Self-mgmt. Tools & Techniques
5 Tools & Techniques for Working With Others

Applied Learning

English Language Arts required by the task

Students were asked to state a judgment of something, e.g., a movie, book, author, teacher, sports team, consumer product. They were to support their judgment with evidence from personal experience as well as from a careful analysis and thoughtful understanding of the subject.

Circumstances of performance

✓	timed assignment
	extended project
	opportunity for revision
✓	first draft
	revised draft
	teacher generated topic
✓	student generated topic
	embedded in class work
	research required

This work sample provides evidence for the quality of work expected for the following parts of the English Language Arts standards:

Standard 2, Writing—produces a response to literature;
Standard 5, Literature—responds to fiction, non-fiction, poetry, and drama.

Writing

The student produces:

A response to literature, in which the writer:

- **engages the reader through establishing a context, creating a persona, and otherwise developing reader interest;**
- **advances a judgment that is interpretive, analytic, evaluative, or reflective;**
- **supports a judgment through references to the text, references to other works, authors, or non-print media, or references to personal knowledge;**
- **demonstrates an understanding of the literary work;**
- **anticipates and answers a reader's questions.**

This work provides evidence that the student:

- engages the reader by establishing the writer's qualifications: "I watch a great deal [of television]";
- firmly states a judgment: "the one program which I think stands out from the rest is 'Star Trek: The Next Generation'";
- supports the judgment with several well developed reasons, e.g., "variety of plots," "mind-boggling special effects," connections to "its precedent Star Trek";
- further supports the judgment by offering an explanation for the success of the series, arguing that the new series is "Unlike other television science fiction shows…in which the heroes are always blasting away at some hostile alien," and by using instead "different story lines," such as "mysteries" or "time travels."

Literature

The student responds to fiction, non-fiction, poetry, and drama using interpretive, critical, and evaluative processes; that is, the student does one or more of the following in oral or written presentations:

- **analyzes the reasons for a character's actions, taking into account the situation and basic motivation of the character;**
- **identifies recurring themes across works;**
- **identifies stereotypical characters as opposed to fully developed characters;**
- **makes inferences and draws conclusions about context, events, characters, setting, and theme;**
- **identifies the effect of literary devices such as figurative language, allusion, diction, dialogue, and description;**
- **interprets the impact of authors' decisions regarding word choice, content, and literary elements;**
- **identifies the characteristics of literary forms and genres;**
- **evaluates literary merit;**
- **identifies the effect of point of view.**

This work provides evidence that the student:

- briefly analyzes two characters, drawing a connection between Dr. Spock in the original series and Mr. Data in the new series;
- identifies a recurring theme across science fiction genres by criticizing certain programs for their lack of variety and for "always blasting away at some hostile alien";
- evaluates literary merit by suggesting that "the variety of plots" elevates this series above other "science fiction shows."

Errors in this first draft may be attributed to the nature of the task, which was given in a timed writing situation. The writing was completed in forty-five minutes with no opportunities for review and revision. The spelling and grammatical errors in the work sample do not detract from the overall quality of the work.

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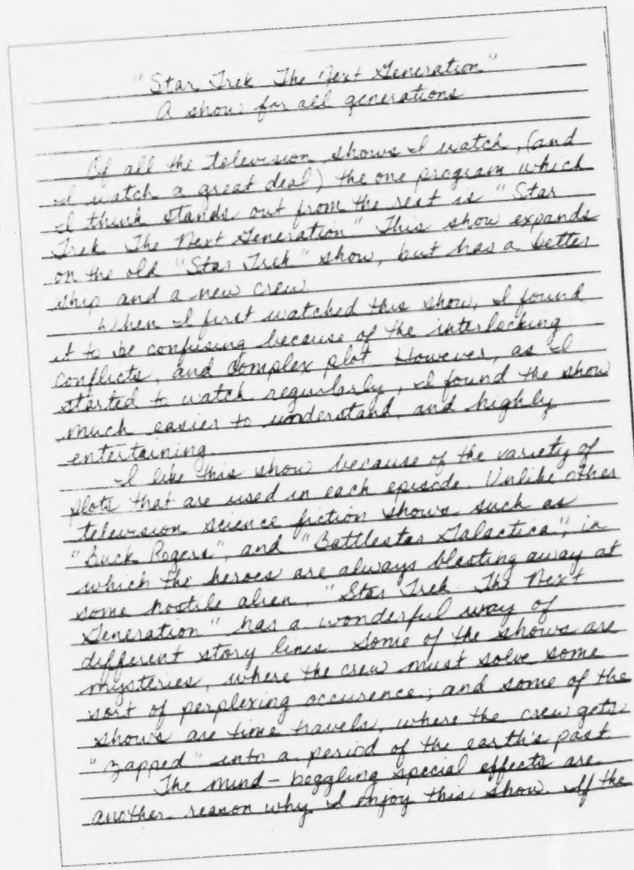
In Norway, students of this age will "receive help to orientate themselves in the flow of information and to develop attitudes which will enable them to choose and evaluate an increasing supply of various forms of media information; experience and interpret messages in artistic forms of presentation."

Curriculum Guidelines for Compulsory Education in Norway, p. 157.



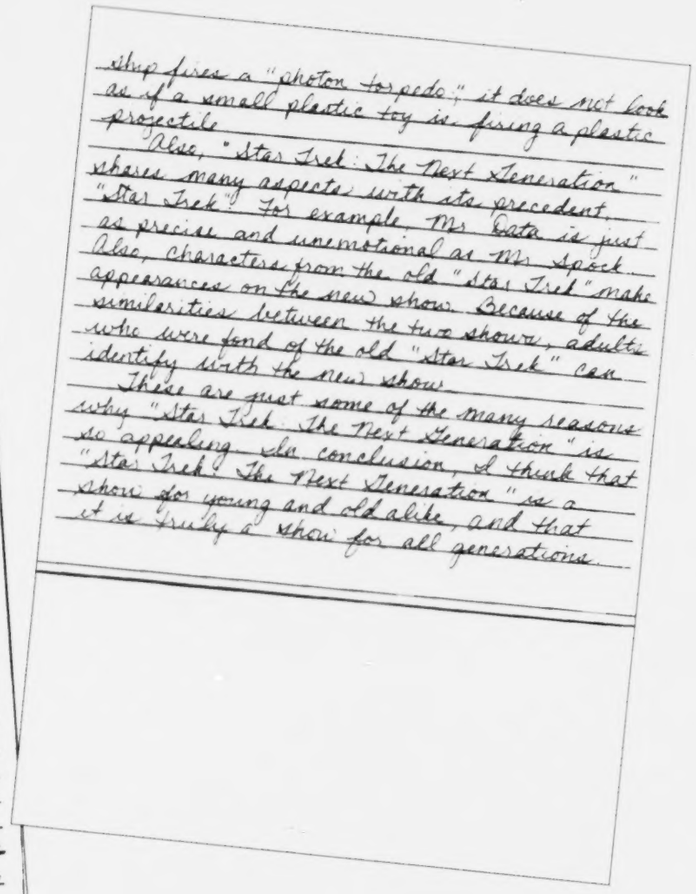
"Star Trek The Next Generation"
A show for all generations

Of all the television shows I watch (and I watch a great deal) the one program which I think stands out from the rest is "Star Trek The Next Generation". This show expands on the old "Star Trek" show, but has a better ship and a new crew.

When I first watched this show, I found it to be confusing because of the interlocking conflicts and complex plot. However, as I started to watch regularly, I found the show much easier to understand, and highly entertaining.

I like this show because of the variety of plots that are used in each episode. Unlike other television science fiction shows such as "Buck Rogers" and "Battlestar Galactica", in which the heroes are always blasting away at some hostile alien, "Star Trek The Next Generation" has a wonderful way of different story lines. Some of the shows are mysteries, where the crew must solve some sort of perplexing occurrence; and some of the shows are time travels, where the crew gets "zapped" into a period of the earth's past.

The mind-boggling special effects are another reason why I enjoy this show. If the



ship fires a "photon torpedo," it does not look as if a small plastic toy is firing a plastic projectile.

Also, "Star Trek: The Next Generation" shares many aspects with its precedent, "Star Trek." For example, Mr. Data is just as precise and unemotional as Mr. Spock. Also, characters from the old "Star Trek" make appearances on the new show. Because of the similarities between the two shows, adults who were fond of the old "Star Trek" can identify with the new show.

These are just some of the many reasons why "Star Trek: The Next Generation" is so appealing. In conclusion, I think that "Star Trek: The Next Generation" as a show for young and old alike, and that it is truly a show for all generations.

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Work Sample & Commentary: *A Geographical Report*

1 Reading	2 Writing	3 Speaking, Listening & Viewing	4 Conventions, Grammar & Usage	5 Literature

English Language Arts

1 Number & Operation Concepts	2 Geometry & Measurement Concepts	3 Function & Algebra Concepts	4 Statistics & Probability Concepts	5 Problem Solving & Mathematical Reasoning	6 Mathematical Skills & Tools	7 Mathematical Communication	8 Putting Mathematics to Work

Mathematics

1 Physical Sciences Concepts	2 Life Sciences Concepts	3 Earth & Space Sciences Concepts	4 Scientific Connections & Applications	5 Scientific Thinking	6 Scientific Tools & Technologies	7 Scientific Communication	8 Scientific Investigation

Science

1 Problem Solving	2 Communication Tools & Techniques	3 Information Tech. Tools & Techniques	4 Learning & Self-mgmt. Tools & Techniques	5 Tools & Techniques for Working With Others

Applied Learning

An extended project, here, is one that has occurred over a sustained period of time, generally at least one week, and often longer.

English Language Arts required by the task

The task required students to define an interesting question that could be answered through scientific research. The task required students to conduct a review of the research and to produce a report of information. Illustrations to clarify key points were encouraged, as was the inclusion of a complete bibliography.

Circumstances of performance

	timed assignment
✓	extended project
✓	opportunity for revision
	first draft
✓	revised draft
	teacher generated topic
✓	student generated topic
✓	embedded in class work
✓	research required

This work sample provides evidence for the quality of work required for the following parts of the English Language Arts standards:

Standard 1, Reading—reads informational materials;
Standard 2, Writing—produces a report;
Standard 4, Conventions, Grammar, and Usage of the English Language—uses appropriate conventions.

Reading

The student reads informational materials to develop understanding and expertise and produces written or oral work that:

- **restates or summarizes information;**
- **relates new information to prior knowledge and experience;**
- **extends ideas;**
- **makes connections to related topics or information.**

This work provides evidence that the student:

- clearly restates and summarizes information acquired through a number of interviews, e.g., in the section titled "What Vernal Pools Are";
- relates new information to prior knowledge, e.g., in the sections titled "Protection Techniques" and "Survey Results";
- extends ideas by speculating about the topic, e.g., in the section titled "Recognizing An Asset";
- makes connections by reflecting on the implications inherent in the information gathered, e.g., in the "Conclusion."

Writing

The student produces:

A report, in which the writer:

- **engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;**
- **develops a controlling idea that conveys a perspective on the subject;**
- **creates an organizing structure appropriate to purpose, audience, and context;**
- **includes appropriate facts and details;**
- **excludes extraneous and inappropriate information;**
- **uses a range of appropriate strategies, such as providing facts and details, describing or analyzing the subject, narrating a relevant anecdote, comparing and contrasting, naming, and explaining benefits or limitations.**

This work provides evidence that the student:

- establishes a context by identifying the subject of the report as "a very rare and unique wetland" [p. 3] and by posing a significant question: "how can you establish vernal pools being thought of as a geographical asset?" [p. 3];
- engages the reader by creating, in the section on "Methods," the authoritative persona of a reasonable, intelligent individual who takes logical steps to find information, by referring to "public libraries," "a university library," "several authorities in the field," "several maps and photos," "charts of changing land use," and developing "a questionnaire" which "surveyed two classrooms…and a group of forty-two adults" [pp. 3-4];
- develops a controlling idea by posing a question, i.e., "how can you establish vernal pools…?" [p. 3]; as is evident in the sections "What Vernal Pools Are" through "Recognizing An Asset," uses the information gathered [pp. 4-12]; and concludes that "A balance between expansion and preservation will not come easily, but…will shift toward long-term vernal pool preservation" [p. 12];
- creates an appropriate organizing structure by dividing the report into appropriate sections;
- includes appropriate facts and details, e.g., in the section titled "What Vernal Pools Are" [pp. 4-6]; provides graphic illustrations [pp. 5-7];
- avoids including extraneous data or inappropriate information;
- uses a range of appropriate strategies, e.g., includes, in the section titled "Recognizing An Asset," adequate illustrations and diagrams and argues persuasively for the benefits of educating the public about vernal pool preservation [pp. 11-12].

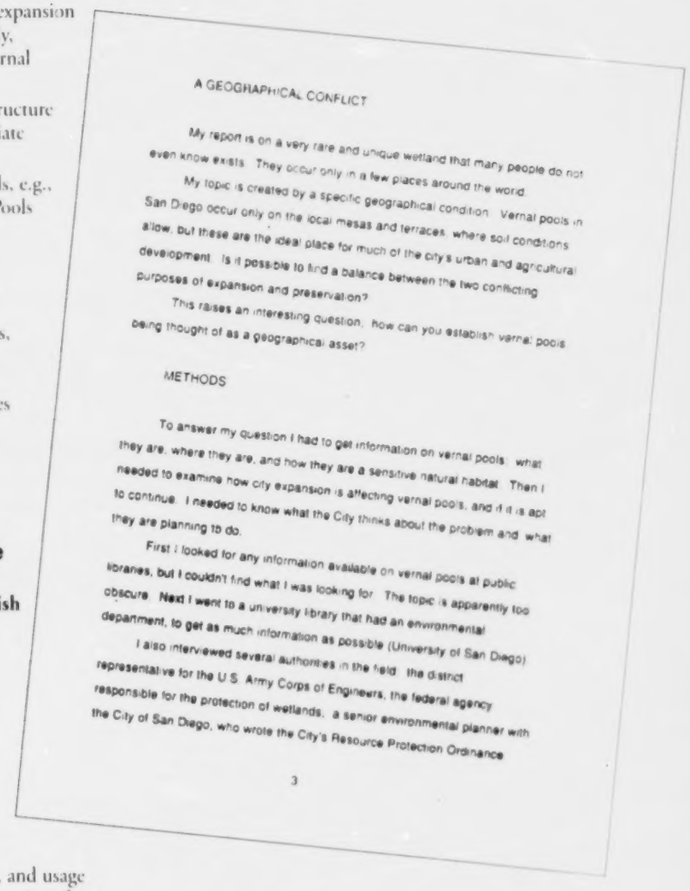
Conventions, Grammar, and Usage of the English Language

The student independently uses appropriate conventions of the English language, including:

- **spelling;**
- **sentence construction;**
- **paragraph structure;**
- **punctuation;**
- **grammar;**
- **usage.**

This work provides evidence that the student:

- manages the conventions, grammar, and usage of English so that they aid rather than interfere with reading;
- manages a variety of sentence constructions, e.g., paragraph three in "Methods"; and of paragraph structure, e.g., paragraph three in "What Vernal Pools Are."



A GEOGHAPHICAL CONFLICT

My report is on a very rare and unique wetland that many people do not even know exists. They occur only in a few places around the world.

My topic is created by a specific geographical condition. Vernal pools in San Diego occur only on the local mesas and terraces, where soil conditions allow, but these are the ideal place for much of the city's urban and agricultural development. Is it possible to find a balance between the two conflicting purposes of expansion and preservation?

This raises an interesting question, how can you establish vernal pools being thought of as a geographical asset?

METHODS

To answer my question I had to get information on vernal pools, what they are, where they are, and how they are a sensitive natural habitat. Then I needed to examine how city expansion is affecting vernal pools, and if it is apt to continue. I needed to know what the City thinks about the problem and what they are planning to do.

First I looked for any information available on vernal pools at public libraries, but I couldn't find what I was looking for. The topic is apparently too obscure. Next I went to a university library that had an environmental department, to get as much information as possible (University of San Diego)

I also interviewed several authorities in the field. the district representative for the U.S. Army Corps of Engineers, the federal agency responsible for the protection of wetlands, a senior environmental planner with the City of San Diego, who wrote the City's Resource Protection Ordinance

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(RPO), the Station botanist at Miramar Naval Air Station, who is in charge of their vernal pool management plan on the land that has the largest number of pools remaining in the City of San Diego; a biologist working for RECON (Regional Environmental Consultants), a firm which is mapping the vernal pools for the City of Hemet, (another city in San Diego County facing the same issues); and finally a geographer working for SANDAG (San Diego Association of Governments), a regional organization that gathers, records, and analyzes data associated with regional planning and environmental issues. They answered many questions and offered their own ideas and information, including additional articles on my subject. I looked at several maps and photos of vernal pool locations, and charts of changing land use.

To decide how much education may be needed about vernal pools, I made a questionnaire, and surveyed two classrooms of elementary students, and a group of forty-two adults, trying to cover most age groups.

WHAT VERNAL POOLS ARE

Vernal pools are a unique and rare form of wetland. Wetlands are areas that are covered or soaked by water enough to support plants that grow only in moist ground. Some examples of wetlands are bogs, swamps, marshes, and edges of lakes and streams. These are what people think of when they hear "wetland". But vernal pools are different than these other types of wetlands. They are located on dry and flat places. No one would expect to find a wetland in such a dry area!

San Diego vernal pools are surrounded by small mounds called "mima mounds". The name mima mounds comes from the Mima Prairie near Olympia, Washington. People don't know for sure how mima mounds are formed. Some

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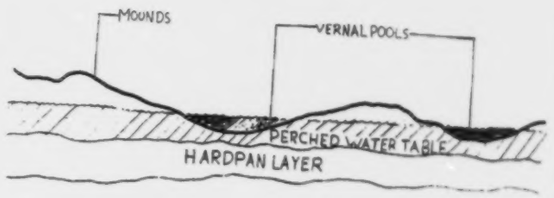
think that they were formed by gophers piling up the earth. Others think that ice wedges from glaciers caused the upheaval, or maybe the wind pushed loose dirt, catching in clumps of shrubs. Mounds can be found on prairies or terraces with a hardpan or clay layer underneath.

Vernal pools are depressions between the mima mounds. In winter the pools are filled by rain storms. In spring the pools look their best, when plants are in full splendor. By summer the pools are dry and look only like a dry pothole. (See illustration of pool cycles and typical cross section.) A vernal pool does not dry by soaking into the ground; the layer of clay or rock underneath the pool prevents the water from soaking through. Instead they dry out from evaporation, or use by the plants. The mima mounds are not impervious so one pool tends to drain into another. Therefore, the pools have to be on flat land; the pools cannot be on a slope or the water would run off, and the pools would not be filled.



TYPICAL CROSS SECTION OF VERNAL POOL

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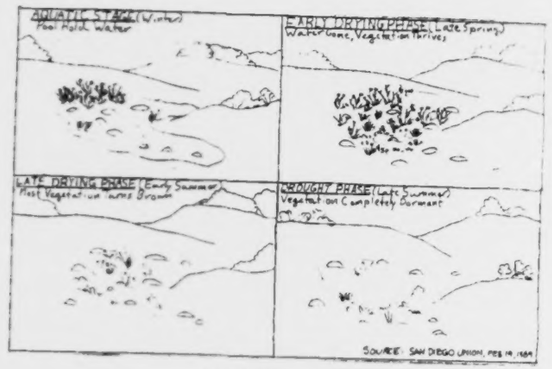
AQUATIC STAGE (Winter)
Pool Holds Water
EARLY DRYING PHASE (Late Spring)
Water Gone, Vegetation Thrives
LATE DRYING PHASE (Early Summer)
Most Vegetation Turns Brown
DROUGHT PHASE (Late Summer)
Vegetation Completely Dormant
SOURCE: SAN DIEGO UNION, FEB 19, 1984

VERNAL POOL CYCLE

WHY VERNAL POOLS ARE SO IMPORTANT

Vernal pools are a very rare, specific habitat. Hardly any are left, so we don't have many to lose. There used to be vernal pools on many of the mesas and terraces of San Diego County, and the Central Valley of California. Now there are almost no vernal pools in the Central Valley, and an estimated 97% have been lost in San Diego County. An estimated 80% of the remaining pools in San Diego are located on Miramar Naval Air Station. (See map, next page.)

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Japanese students in the middle school years are expected "to deepen their ways of observing and thinking, to acquire the ability to express themselves properly according to the purpose or situation, and to develop an attitude of utilizing the ability to express themselves in daily life." The science curriculum for these students asks them "to cultivate the ability to inquire into nature and to cultivate the formation of fundamental concepts naturally and step-by-step, by effectively utilizing the local environment and actual situation of the school and emphasizing the students' direct experience of natural matters and phenomena."

Course of Study for Lower Secondary Schools in Japan, pp. 9 and 60.

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Work Sample & Commentary: *A Geographical Report continued*

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Science

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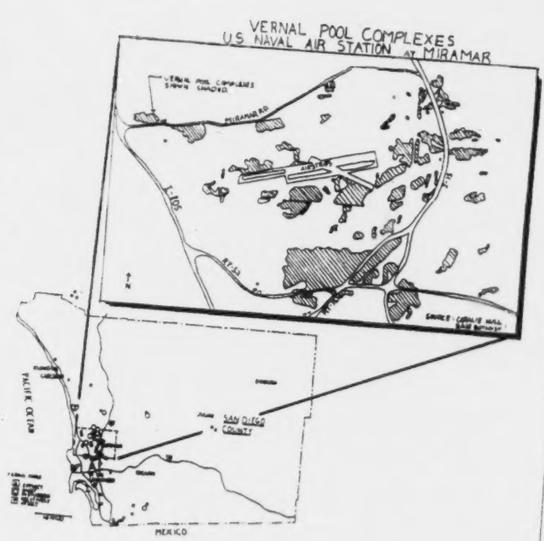
Applied Learning



VERNAL POOL DISTRIBUTION, SAN DIEGO COUNTY

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it does not take much to disturb a vernal pool. Even grazing or off road vehicle use in the summer, when pool species are dormant and people could think they are just a dry hole, can damage them. Most are disturbed by grading and flattening of their habitat, or by breakup of the impervious layer. With just flat land there would be no depressions for vernal pools to form; what would form would be "vernal mud". With no impervious layer the water would just sink into the ground, and would be there only for a short period of time, not enough for wetland plants.

The mima mounds have to be protected too. If the watershed for the pools is changed, the condition of the pools changes. If there isn't enough water from runoff, then all plant or animal life in them disappears, because they need enough moisture at the right time, to live. If there is too much water, then the pool may turn into another kind of wetland, such as a bog.

Although people have begun to study them, there is still a lot to learn. One thing scientists know is that they are a part of a larger environment. Many animals travel from other areas to feed on plants or animals , or drink from the vernal pools. For example, water fowl from many other places will stop at the pools to eat the fairy shrimp and snack on the plants.

Vernal pools have a large assortment of rare and exotic flora and fauna (plants and animals). Five of them are on the federal list of endangered species, and one more is a candidate for listing. The plants and animals in vernal pools are unusual because they have only developed recently compared to other changes in evolution. As scientists study the pools more intently they are finding more and more unknown species. There are temporary pools in other places around the world, but California's vernal pools are different because of their long drought phase, which causes the plants and animals to adapt to the climate. They go into a dormant phase. For example, fairy shrimp

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lay eggs before the drought which hatch when it gets moist enough to be active. Some plants, in a short period of time, develop seeds; others appear to die out, but quickly sprout again from the rain. Many of these species cannot survive outside vernal pools, and some are "endemic" (species found only in a very restricted geographical area).

PROTECTION TECHNIQUES

The first step is to try to keep development away from vernal pools. But to do this you first need to know where the pools are. Thanks to regional mapping efforts, existing vernal pools have been fairly well identified in San Diego County.

There are already laws against disturbances of vernal pools. You could go to jail or get fined a large sum of money for disturbing a wetland. The U.S. Fish and Wildlife Service protects the listed endangered species present, and the U.S. Army Corps of Engineers makes sure you don't fill any kind of wetland habitat, including vernal pools. The local office of the U.S. Army Corps of Engineers has submitted a proposal to Washington for a stricter permit process for vernal pools.

When possible the vernal pools should be part of a large preserve of open space. That way the pools would not be isolated islands, but part of their natural communities, and would be protected by a buffer of distance. Fences should not be put directly around the vernal pools unless it cannot be avoided, because it would keep some animals out, such as rabbits which spread plant seeds around when they eat them.

It is important to educate people about vernal pools so they know how important they are and what they look like, and so they know how to preserve

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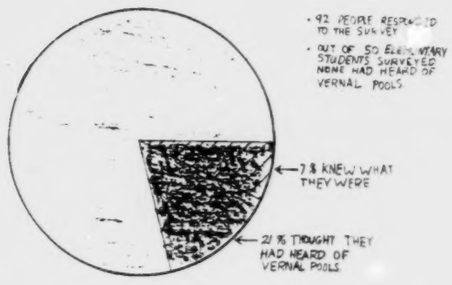
them. To see how much education may be needed in San Diego, I surveyed ninety-two people (forty-two adults and fifty elementary students to try to cover all age groups). I asked them if they had heard of vernal pools, and if they knew what they were. About 21% thought they had heard of them, but only 7% really knew what they were. (See pie chart.) I found that much education is needed.


• 92 PEOPLE RESPONDED TO THE SURVEY
• OUT OF 50 ELEMENTARY STUDENTS SURVEYED NONE HAD HEARD OF VERNAL POOLS
7 % KNEW WHAT THEY WERE
21 % THOUGHT THEY HAD HEARD OF VERNAL POOLS

SURVEY RESULTS

At N.A.S. Miramar the Station botanist has been putting articles dealing with vernal pools in almost every issue of the base newspaper. Now most people on the base know about vernal pools, and know how valuable they are.

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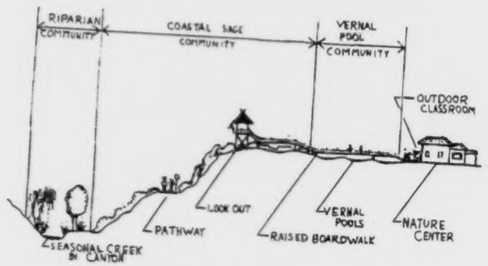
RECOGNIZING AN ASSET

Education is a key to preserving vernal pools. Vernal pools are very unique and we do not have many to lose. Making new ones does not work. Studies done at the University of California, Santa Barbara, have shown that after five years their complexity goes down.

First, vernal pools must be protected. There could be different ranges of accessibility, from remote (available to research only), somewhat accessible (good for guided seasonal visits), to readily accessible (which may have to be protected by fencing or supervision). The most accessible ones would be a great educational opportunity for the general public. The pools closer to development could be developed into nature centers, with raised boardwalks to protect the habitat, as is done over the hot springs in Yellowstone. (See illustration.)



CROSS SECTION OF POSSIBLE NATURE CENTER

11

Interpretive signs and docents could provide information. Being very unique, vernal pools would make interesting learning centers. People would learn how the plants and animals adapt to the seasonal changes. This would teach people the importance of vernal pools, how complex they are, how to identify them, and how to preserve them when wet or dry. A park in the Sacramento area has an adjacent vernal pool with hiking trails around it, and it seems to work there because the people there know how important and delicate it is.

Ecotourism, a popular concept now, would be another idea. San Diego is a place where tourists already come. The very climate and geography that brings people here is what created vernal pools. Ecotourism would be easy to add to the other attractions, and would indirectly benefit the city. A tour company might be authorized to place advertisements to bring people to learn the importance of vernal pools and their ecosystem. With many people outside San Diego knowing about vernal pools and concerned about their well-being, there would be widespread support for vernal pool protection.

CONCLUSION

The problem of endangering vernal pools will not go away, because the City will need more land to develop. However, vernal pools remain a rare and unique wetland, and need protection. Even though there are laws made to protect them, pools are still being lost. Education is needed. Widespread education showing how important vernal pools are, and how easy they are to disturb, will create widespread support for protection.

A balance between expansion and preservation will not come easily, but if the public views vernal pools as a geographical asset, the balance will shift toward long-term vernal pool preservation.

12

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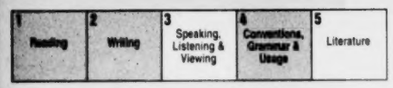
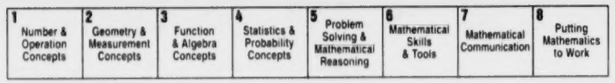
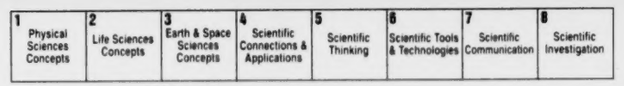
Work Sample & Commentary: *Analysis of* The Old Man and The Sea



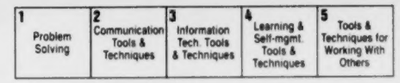
English Language Arts


1 Number & Operation Concepts
2 Geometry & Measurement Concepts
3 Function & Algebra Concepts
4 Statistics & Probability Concepts
5 Problem Solving & Mathematical Reasoning
6 Mathematical Skills & Tools
7 Mathematical Communication
8 Putting Mathematics to Work

Mathematics


1 Physical Sciences Concepts
2 Life Sciences Concepts
3 Earth & Space Sciences Concepts
4 Scientific Connections & Applications
5 Scientific Thinking
6 Scientific Tools & Technologies
7 Scientific Communication
8 Scientific Investigation

Science


1 Problem Solving
2 Communication Tools & Techniques
3 Information Tech. Tools & Techniques
4 Learning & Self-mgmt. Tools & Techniques
5 Tools & Techniques for Working With Others

Applied Learning

This extraordinary piece of writing is typical of this student. It comes from her New Standards portfolio.

English Language Arts required by the task

Students were instructed to write a critical analysis of a work of their choice.

Circumstances of performance

	timed assignment
	extended project
✓	opportunity for revision
	first draft
✓	revised draft
	teacher generated topic
✓	student generated topic
✓	embedded in class work
	research required

This work sample provides evidence for the quality of work expected for the following parts of the English Language Arts standards:

Standard 1, Reading—reads and comprehends material; reads in depth;
Standard 2, Writing—produces a response to literature;
Standard 4, Conventions, Grammar, and Usage of the English Language—uses appropriate conventions.

Reading

The student reads and comprehends material of the quality and complexity illustrated in the sample reading list equivalent to twenty-five books each year. The materials should include traditional and contemporary literature or the equivalent in magazines, newspapers, textbooks, and media, from at least three different literary genres and from at least five different writers. The student produces evidence of reading that:

- **demonstrates a thorough understanding of the text as a whole;**
- **identifies complexities presented in the text, i.e., ideas, information, levels of meaning;**
- **extracts salient information from the text;**
- **uses paraphrasing judiciously.**

This work provides evidence for the quality of work expected for this part of the reading standard. However, to say that the student has met this part of the reading standard, it would be necessary to include additional work of comparable quality.

This work provides evidence that the student:

- demonstrates comprehension of the novel, e.g., the first paragraph summarizes the major elements of the plot;
- demonstrates comprehension of the conflict within the plot, e.g., "As the story progresses, Hemingway presents…Santiago refusing to be destroyed by the forces that threaten to defeat him";
- demonstrates comprehension by interpreting the actions of the main character, [e.g., par. 2-4].

The student reads in depth at least four books (or book equivalents) about one issue or subject, or four books by a single writer, or four books in one genre, and produces evidence of reading that:

- **makes and supports warranted and responsible assertions about the texts;**
- **supports assertions with elaborated and convincing evidence;**
- **makes perceptive and well developed connections;**
- **evaluates writing strategies and elements of the author's craft.**

This work provides evidence for the quality of work expected for this part of the reading standard. However, to say that the student has met this part of the reading standard, it would be necessary to include additional work of comparable quality.

This work provides evidence that the student:

- makes warranted assertions about the text: "Hemingway's quote 'a man can be destroyed but not defeated' offers a key insight into Santiago's life";
- supports the assertions with evidence from the text, where paragraphs two, three, and four each tell a part of the story, e.g., in paragraph four the student recounts the episode in which the large fish Santiago finally catches is eaten by sharks, and then comments on the significance of the events, e.g., "No one can take away his love for Manolin or memories of what once was, and because of this, no one can ever truly defeat Santiago" as they relate to the initial thesis: "Hemingway's quote 'a man can be destroyed but not defeated' offers a key insight into Santiago's life."

Writing

A response to literature, in which the writer:

- **engages the reader through establishing a context, creating a persona, and otherwise developing reader interest;**
- **advances a judgment that is interpretive, analytic, evaluative, or reflective;**
- **supports a judgment through references to the text, references to other works, authors, or non-print media, or references to personal knowledge;**
- **demonstrates an understanding of the literary work;**
- **anticipates and answers a reader's questions.**

This work provides evidence that the student:

- engages the reader through a brief summary of the plot in the first paragraph;
- establishes a context in the final sentence of the first paragraph by incorporating a quotation into the guiding statement or thesis, i.e., "As his suffering and loss compound, we can see that Hemingway's quote 'a man can be destroyed but not defeated' offers a key insight into Santiago's life";
- advances an interpretive judgment, e.g., "Santiago does not let the loss of his friend or the defeat that others see him suffering keep him off the sea…and prepares to catch the biggest fish of his life";
- supports assertions about the piece through references to the text;
- demonstrates an understanding of the literary work by making evaluative judgments that connect Santiago's dreams of lions to his victory over tremendous odds, e.g., "This is perhaps the truest test of how much courage and determination a person has" and "no one can ever truly defeat Santiago";
- organizes the material logically by using two key elements of the quotation from the thesis statement as devices to guide the structure, i.e., "destroyed" but "not defeated" are the elements which are repeated in each paragraph; the concluding paragraph returns to the quotation in the guiding statement.

Conventions, Grammar, and Usage of the English Language

The student independently uses appropriate conventions of the English language, including:

- **spelling;**
- **sentence construction;**
- **paragraph structure;**
- **punctuation;**
- **grammar;**
- **usage.**

This work provides evidence that the student:

- manages the conventions, grammar, and usage of English so that they aid rather than interfere with reading;
- manages a variety of sentence constructions [par. 3] and of paragraph structure, e.g., see paragraph three for use of detail to develop the paragraph.

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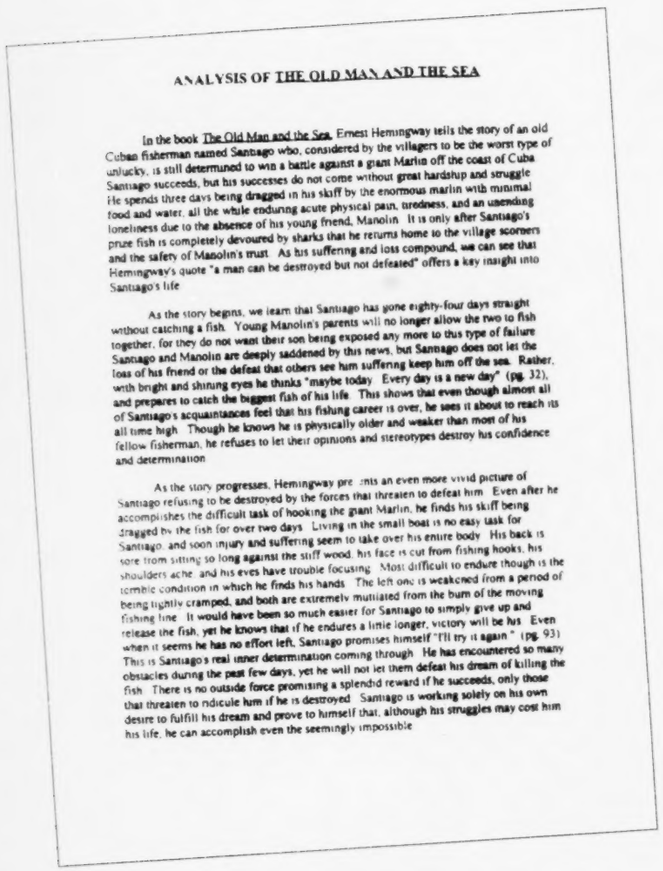
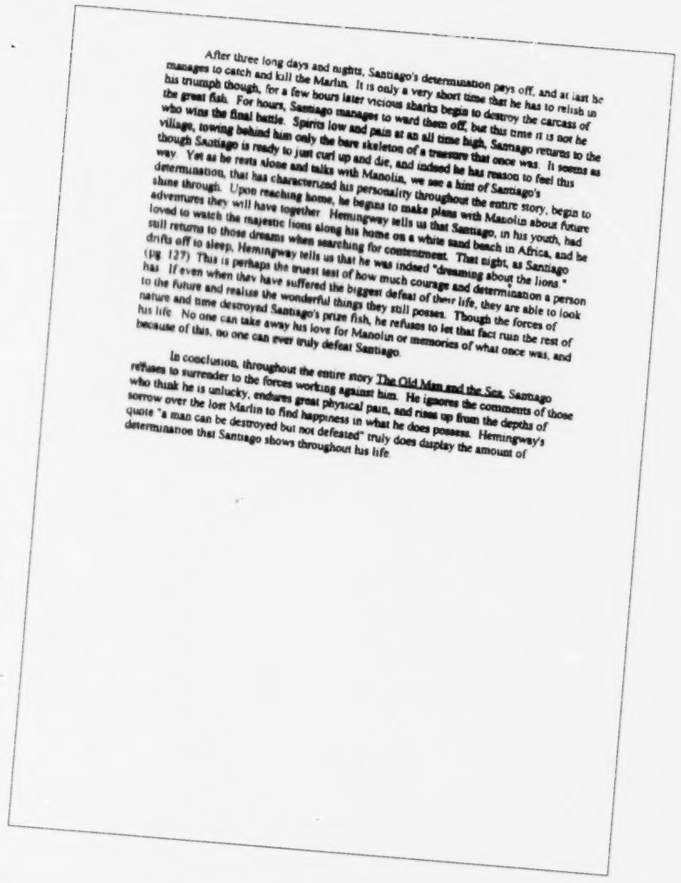


ANALYSIS OF THE OLD MAN AND THE SEA

In the book The Old Man and the Sea, Ernest Hemingway tells the story of an old Cuban fisherman named Santiago who, considered by the villagers to be the worst type of unlucky, is still determined to win a battle against a giant Marlin off the coast of Cuba. Santiago succeeds, but his successes do not come without great hardship and struggle. He spends three days being dragged in his skiff by the enormous marlin with minimal food and water, all the while enduring acute physical pain, tiredness, and an unending loneliness due to the absence of his young friend, Manolin. It is only after Santiago's prize fish is completely devoured by sharks that he returns home to the village scorners and the safety of Manolin's trust. As his suffering and loss compound, we can see that Hemingway's quote "a man can be destroyed but not defeated" offers a key insight into Santiago's life.

As the story begins, we learn that Santiago has gone eighty-four days straight without catching a fish. Young Manolin's parents will no longer allow the two to fish together, for they do not want their son being exposed any more to this type of failure. Santiago and Manolin are deeply saddened by this news, but Santiago does not let the loss of his friend or the defeat that others see him suffering keep him off the sea. Rather, with bright and shining eyes he thinks "maybe today. Every day is a new day" (pg. 32), and prepares to catch the biggest fish of his life. This shows that even though almost all of Santiago's acquaintances feel that his fishing career is over, he sees it about to reach its all time high. Though he knows he is physically older and weaker than most of his fellow fisherman, he refuses to let their opinions and stereotypes destroy his confidence and determination.

As the story progresses, Hemingway pre ents an even more vivid picture of Santiago refusing to be destroyed by the forces that threaten to defeat him. Even after he accomplishes the difficult task of hooking the giant Marlin, he finds his skiff being dragged by the fish for over two days. Living in the small boat is no easy task for Santiago, and soon injury and suffering seem to take over his entire body. His back is sore from sitting so long against the stiff wood, his face is cut from fishing hooks, his shoulders ache, and his eyes have trouble focusing. Most difficult to endure though is the terrible condition in which he finds his hands. The left one is weakened from a period of being tightly cramped, and both are extremely mutilated from the burn of the moving fishing line. It would have been so much easier for Santiago to simply give up and release the fish, yet he knows that if he endures a little longer, victory will be his. Even when it seems he has no effort left, Santiago promises himself "I'll try it again." (pg. 93). This is Santiago's real inner determination coming through. He has encountered so many obstacles during the past few days, yet he will not let them defeat his dream of killing the fish. There is no outside force promising a splendid reward if he succeeds, only those that threaten to ridicule him if he is destroyed. Santiago is working solely on his own desire to fulfill his dream and prove to himself that, although his struggles may cost him his life, he can accomplish even the seemingly impossible.



After three long days and nights, Santiago's determination pays off, and at last he manages to catch and kill the Marlin. It is only a very short time that he has to relish in his triumph though, for a few hours later vicious sharks begin to destroy the carcass of the great fish. For hours, Santiago manages to ward them off, but this time it is not he who wins the final battle. Spirits low and pain at an all time high, Santiago returns to the village, towing behind him only the bare skeleton of a treasure that once was. It seems as though Santiago is ready to just curl up and die, and indeed he has reason to feel this way. Yet as he rests alone and talks with Manolin, we see a hint of Santiago's determination, that has characterized his personality throughout the entire story, begin to shine through. Upon reaching home, he begins to make plans with Manolin about future adventures they will have together. Hemingway tells us that Santiago, in his youth, had loved to watch the majestic lions along his home on a white sand beach in Africa, and he still returns to those dreams when searching for contentment. That night, as Santiago drifts off to sleep, Hemingway tells us that he was indeed "dreaming about the lions." (pg. 127) This is perhaps the truest test of how much courage and determination a person has. If even when they have suffered the biggest defeat of their life, they are able to look to the future and realize the wonderful things they still posses. Though the forces of nature and time destroyed Santiago's prize fish, he refuses to let that fact ruin the rest of his life. No one can take away his love for Manolin or memories of what once was, and because of this, no one can ever truly defeat Santiago.

In conclusion, throughout the entire story The Old Man and the Sea, Santiago refuses to surrender to the forces working against him. He ignores the comments of those who think he is unlucky, endures great physical pain, and rises up from the depths of sorrow over the lost Marlin to find happiness in what he does possess. Hemingway's quote "a man can be destroyed but not defeated" truly does display the amount of determination that Santiago shows throughout his life.

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In France, teachers should see to it that "the texts studied in class are within reach of the students, suited to their abilities and to their needs, accessible in terms of length and content. They offer the students the possibility to discover themselves, to understand others, and to extend their curiosity about cultures and realities that are strange to them and that they do not know well."

Colléges: Programmes et Instructions, p. 29.

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Work Sample & Commentary: *Illuminati*

1 Reading	2 Writing	3 Speaking, Listening & Viewing	4 Conventions, Grammar & Usage	5 Literature

English Language Arts

1 Number & Operation Concepts	2 Geometry & Measurement Concepts	3 Function & Algebra Concepts	4 Statistics & Probability Concepts	5 Problem Solving & Mathematical Reasoning	6 Mathematical Skills & Tools	7 Mathematical Communication	8 Putting Mathematics to Work

Mathematics

1 Physical Sciences Concepts	2 Life Sciences Concepts	3 Earth & Space Sciences Concepts	4 Scientific Connections & Applications	5 Scientific Thinking	6 Scientific Tools & Technologies	7 Scientific Communication	8 Scientific Investigation

Science

1 Problem Solving	2 Communication Tools & Techniques	3 Information Tech. Tools & Techniques	4 Learning & Self-mgmt. Tools & Techniques	5 Tools & Techniques for Working With Others

Applied Learning

Young people in Sweden are expected to "read and understand literature of various types, both young adult books as well as classical and modern adult literature and even texts in Norwegian and Danish."

Kursplaner för Grundskolan, p. 106.

English Language Arts required by the task

Students were asked to explain what they liked and/or disliked about a book they had read and to support the judgments by giving reasons for the evaluation.

Circumstances of performance

✓	timed assignment
	extended project
	opportunity for revision
✓	first draft
	revised draft
	teacher generated topic
✓	student generated topic
	embedded in class work
	research required

This work sample provides evidence for the quality of work expected for the following parts of the English Language Arts standards:

Standard 1, Reading—reads and comprehends material;
Standard 2, Writing—produces a response to literature;
Standard 4, Conventions, Grammar, and Usage of the English Language—uses appropriate conventions.

Reading

The student reads and comprehends material of the quality and complexity illustrated in the sample reading list equivalent to twenty-five books each year. The materials should include traditional and contemporary literature or the equivalent in magazines, newspapers, textbooks, and media, from at least three different literary genres and from at least five different writers. The student produces evidence of reading that:

- **demonstrates a thorough understanding of the text as a whole;**
- **identifies complexities presented in the text, i.e., ideas, information, levels of meaning;**
- **extracts salient information from the text;**
- **uses paraphrasing judiciously.**

This work provides evidence for the quality of work expected for this part of the reading standard. However, to say that the student has met this part of the reading standard, it would be necessary to include additional work of comparable quality.

This work provides evidence that the student:

- shows a thorough understanding of what has been read, by discussing a common element among the various novels, e.g., "conspiracy and coincidence," the setting of the novel, and the "history of secret societies";
- identifies effectively various complexities within the reading [e.g., par. 2, 4, 6, and 7].

Writing

The student produces:

A response to literature, in which the writer:

- **engages the reader through establishing a context, creating a persona, and otherwise developing reader interest;**
- **advances a judgment that is interpretive, analytic, evaluative, or reflective;**
- **supports a judgment through references to the text, references to other works, authors, or non-print media, or references to personal knowledge;**
- **demonstrates an understanding of the literary work;**
- **anticipates and answers a reader's questions.**

This work provides evidence that the student:

- establishes a context for writing the letter, e.g., "I have just finished reading your *Illuminati* trilogy and would like to congratulate you…as well as point out a few of the difficulties…"; organizes the body of the letter accordingly;
- remains within the established context throughout, e.g., by congratulating the author and by critiquing the work;
- engages the reader by creating a reliable persona using a first person voice consistent with the evidence being presented, e.g., "I greatly admire the way you…find conspiracy and coincidence in almost any situation" and "When I read your books I find myself spending a lot of time reminiscing about my old neighborhood and friends in Chicago";
- develops reader interest by balancing the criticism with an equal amount of enthusiasm, e.g., the first four paragraphs of praise indicate a careful and conscientious reading, so that the three points of criticism mentioned subsequently can be seen as coming from a well read rather than an uninformed reader;
- makes evaluative statements, e.g., "a great piece of writing" and "I do, however, find a few problems…";
- supports judgments through references to both primary and secondary texts, e.g., "Although what you write is far from propaganda, the leftist politics tend to get in the way" and "I have looked over a few of the books you quote from…";
- organizes judgment logically by moving from claims about what makes good writing, e.g., the discussion in paragraph two of "conspiracy and coincidence…" and in paragraph four of the "almost perfect balance of conspiracy, seriousness, and humor…," to criticisms presented in the final few paragraphs;
- anticipates possible questions from the author addressed by the letter, e.g., "Instead of intriguing people (which I think was your objective)…."

Conventions, Grammar, and Usage of the English Language

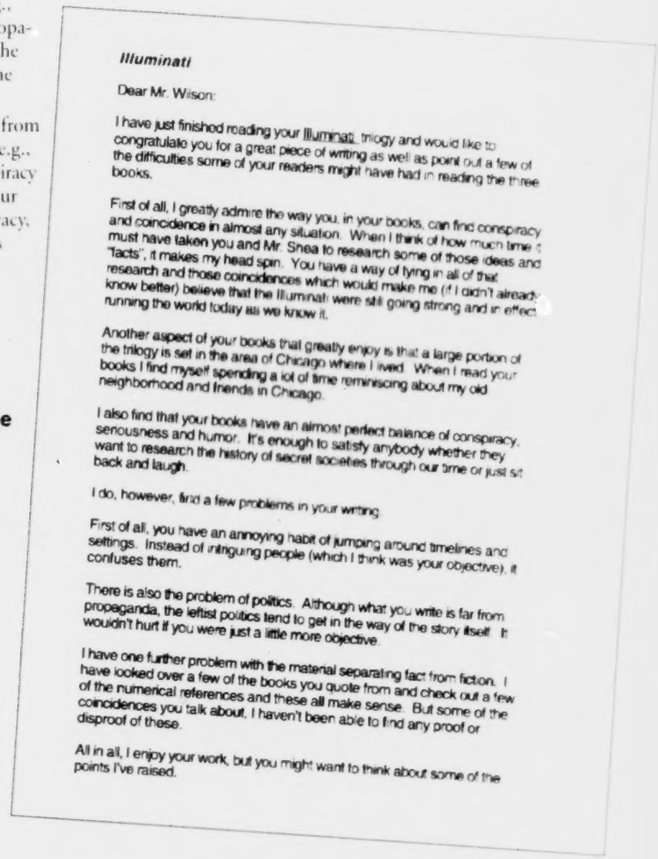
The student independently uses appropriate conventions of the English language, including:

- **spelling;**
- **sentence construction;**
- **paragraph structure;**
- **punctuation;**
- **grammar;**
- **usage.**

This work provides evidence that the student:

- manages the conventions, grammar, and usage of English so that they aid rather than interfere with reading.

Errors in this first draft, e.g., the improper use of the word "check" rather than "checked," may be attributed to the nature of the task, which was given in a timed writing situation. The writing was completed in forty-five minutes with no opportunities for review and revision. The spelling and grammatical errors in the work sample do not detract from the overall quality of the work.



Illuminati

Dear Mr. Wilson:

I have just finished reading your Illuminati trilogy and would like to congratulate you for a great piece of writing as well as point out a few of the difficulties some of your readers might have had in reading the three books.

First of all, I greatly admire the way you, in your books, can find conspiracy and coincidence in almost any situation. When I think of how much time it must have taken you and Mr. Shea to research some of those ideas and "facts", it makes my head spin. You have a way of tying in all of that research and those coincidences which would make me (if I didn't already know better) believe that the Illuminati were still going strong and in effect running the world today as we know it.

Another aspect of your books that greatly enjoy is that a large portion of the trilogy is set in the area of Chicago where I lived. When I read your books I find myself spending a lot of time reminiscing about my old neighborhood and friends in Chicago.

I also find that your books have an almost perfect balance of conspiracy, seriousness and humor. It's enough to satisfy anybody whether they want to research the history of secret societies through our time or just sit back and laugh.

I do, however, find a few problems in your writing.

First of all, you have an annoying habit of jumping around timelines and settings. Instead of intriguing people (which I think was your objective), it confuses them.

There is also the problem of politics. Although what you write is far from propaganda, the leftist politics tend to get in the way of the story itself. It wouldn't hurt if you were just a little more objective.

I have one further problem with the material separating fact from fiction. I have looked over a few of the books you quote from and check out a few of the numerical references and these all make sense. But some of the coincidences you talk about, I haven't been able to find any proof or disproof of these.

All in all, I enjoy your work, but you might want to think about some of the points I've raised.

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Work Sample & Commentary: *Reflections on Reading an Excerpt by Muir*

1 Reading	2 Writing	3 Speaking, Listening & Viewing	4 Conventions, Grammar & Usage	5 Literature

English Language Arts

1 Number & Operation Concepts	2 Geometry & Measurement Concepts	3 Function & Algebra Concepts	4 Statistics & Probability Concepts	5 Problem Solving & Mathematical Reasoning	6 Mathematical Skills & Tools	7 Mathematical Communication	8 Putting Mathematics to Work

Mathematics

1 Physical Sciences Concepts	2 Life Sciences Concepts	3 Earth & Space Sciences Concepts	4 Scientific Connections & Applications	5 Scientific Thinking	6 Scientific Tools & Technologies	7 Scientific Communication	8 Scientific Investigation

Science

1 Problem Solving	2 Communication Tools & Techniques	3 Information Tech. Tools & Techniques	4 Learning & Self-mgmt. Tools & Techniques	5 Tools & Techniques for Working With Others

Applied Learning

English Language Arts required by the task

Students were asked to generate reading logs. One page is excerpted here.

Circumstances of performance

	timed assignment
✓	extended project
	opportunity for revision
✓	first draft
	revised draft
	teacher generated topic
✓	student generated topic
✓	embedded in class work
	research required

This work sample provides evidence for the quality of work expected for the following part of the English Language Arts standards:

Standard 1, Reading—reads and comprehends material.

Reading

The student reads and comprehends material of the quality and complexity illustrated in the sample reading list equivalent to twenty-five books each year. The materials should include traditional and contemporary literature or the equivalent in magazines, newspapers, textbooks, and media, from at least three different literary genres and from at least five different writers. The student produces evidence of reading that:

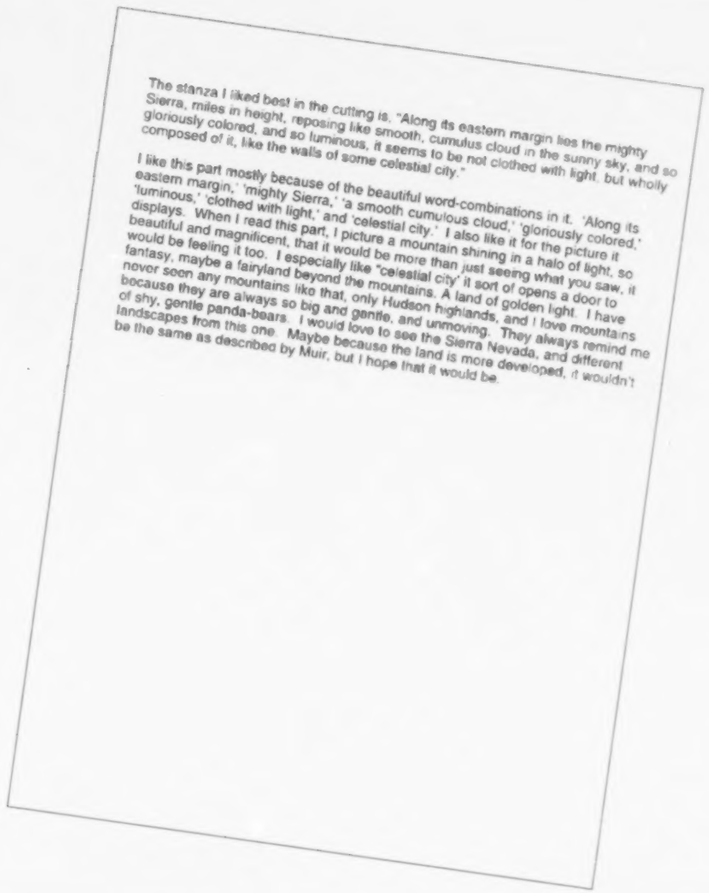
- **demonstrates a thorough understanding of the text as a whole;**
- **identifies complexities presented in the text, i.e., ideas, information, levels of meaning;**
- **extracts salient information from the text;**
- **uses paraphrasing judiciously.**

This work provides evidence for the quality of work expected for this part of the reading standard. However, to say that the student has met this part of the reading standard, it would be necessary to include additional work of comparable quality.

This work provides evidence that the student:

- demonstrates an understanding of the text by examining and responding to the images created by the author and by offering an interpretation of some of the images, e.g., "When I read this part, I picture a mountain shining in a halo of light" and "I especially like 'celestial city' it sort of opens a door to fantasy, maybe a fairy land beyond the mountains";
- further demonstrates understanding by connecting the text to what is known, e.g., "I have never seen any mountains like that, only Hudson highlands…";
- identifies a significant complexity in the text in recognizing that Muir's description may no longer be accurate because of increased land development in the Sierra Nevada range, i.e., "I would love to see the Sierra Nevada" but "Maybe because the land is more developed, it wouldn't be the same as described by Muir."

A reading log is generally first draft writing done quickly for the sake of identifying the gist of what a student has read. The errors in this work include the sentence fragment in the second sentence in paragraph two, the run-on sentence in the middle of paragraph two, the use of "gently" for "gentle" and "seethe" for "see the." These errors do not detract from the overall impression that the student has read and comprehended the work, but they would not be acceptable in polished writing.



The stanza I liked best in the cutting is, "Along its eastern margin lies the mighty Sierra, miles in height, reposing like smooth, cumulus cloud in the sunny sky, and so gloriously colored, and so luminous, it seems to be not clothed with light, but wholly composed of it, like the walls of some celestial city."

I like this part mostly because of the beautiful word-combinations in it. 'Along its eastern margin,' 'mighty Sierra,' 'a smooth cumulous cloud,' 'gloriously colored,' 'luminous,' 'clothed with light,' and 'celestial city.' I also like it for the picture it displays. When I read this part, I picture a mountain shining in a halo of light, so beautiful and magnificent, that it would be more than just seeing what you saw, it would be feeling it too. I especially like "celestial city' it sort of opens a door to fantasy, maybe a fairyland beyond the mountains. A land of golden light. I have never seen any mountains like that, only Hudson highlands, and I love mountains because they are always so big and gentle, and unmoving. They always remind me of shy, gentle panda-bears. I would love to see the Sierra Nevada, and different landscapes from this one. Maybe because the land is more developed, it wouldn't be the same as described by Muir, but I hope that it would be.

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An extended project, here, is one that has occurred over a sustained period of time, generally at least one week, and often longer.

Australian students might give evidence for the "contextual understanding" part of the standard for Reading and Viewing by "showing awareness that language reflects particular purposes, audience and socioeconomic settings by investigating the ways written language changes over time and through the influence of different cultures."

English—a curriculum profile for Australian schools, p. 104.

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Samples of student work that help explain "how good is good enough" for these standards can be found immediately following these pages.

To see how these performance descriptions compare with the expectations for elementary school and high school, turn to pages 82-89.

Several examples have sources cited. See References (p. 104) for details of the sources.

1. Number and Operation Concepts

The student:

- **consistently and accurately adds, subtracts, multiplies, and divides rational numbers; raises rational numbers to whole number powers;**
- **understands the inverse relationships between addition and subtraction, multiplication and division, and exponentiation and root-extraction; and uses the inverse operation to determine unknown quantities in equations;**
- **consistently and accurately computes with, applies, and converts the different kinds and forms of rational numbers, i.e., integers (both whole numbers and negative integers) and other positive and negative rationals, written as decimals, as percents, or as proper, improper, or mixed fractions; irrational numbers, i.e., those that cannot be written as a ratio of two integers, are not required but are suitable for introduction, especially since the student should be familiar with the irrational number π;**
- **is familiar with characteristics of operations and numbers, e.g., divisibility, prime factorization, and with properties of rational numbers, e.g., commutativity and associativity, short of formal statements;**
- **interprets percent as part of 100 and as a means of comparing quantities of different sizes or changing sizes;**
- **reasons proportionally to solve problems involving equivalent fractions or equal ratios;**
- **orders numbers with the > and < relationships and by location on a number line and has a sense of the magnitudes and relative magnitudes of numbers; note that scientific notation is not required.**

Examples of performances that may demonstrate understanding include:

- describing the size of a million of an object, e.g., a shoe box, a penny, a pack of notebook paper, and a millionth of that same object;
- locating .05, .1, 6, ⅞, ¾, -5, and 2.33 on a number line;
- gathering and analyzing data from the neighborhood and comparing the data with published statistics for the city, state, or nation *(see also Applied Learning Standard 1)*;
- figuring out what percent more beef is needed to make a ¾-pound burger into a ⅞-pound burger;
- figuring out how to compute a 15%, 10%, or 20% tip, other than by multiplying an amount by 0.15, 0.1, or 0.2 on paper;
- solving the following problem: Is the sum of two consecutive integers odd or even? Always? How about the product of two consecutive numbers? Why? What can you say about three consecutive numbers?
- finding the last two digits of 6^{1000} *(see NCTM, Mathematics Teaching in the Middle School)*;
- solving the "locker problem": If, in a school of 1,000 lockers, one student opens every locker, another student closes every other locker (2^{nd}, 4^{th}, 6^{th}, etc.), a third student changes every third locker (opens closed lockers and closes open lockers), and so on, until the thousandth student changes the thousandth locker, which lockers are open? Why?

2. Geometry and Measurement Concepts

The student:

- **is familiar with assorted two- and three-dimensional objects, including squares, triangles, other polygons, circles, cubes, rectangular prisms, i.e., "boxes," pyramids, spheres, and cylinders;**
- **identifies similar and congruent shapes and uses transformations in the coordinate plane, i.e., translations, rotations, and reflections;**
- **understands length, area, and volume (as well as the differences between these measurements) and the corresponding uses of units, square units, and cubic units of measure;**
- **recognizes similarity and rotational and bilateral symmetry in two- and three-dimensional figures;**
- **analyzes and generalizes geometric patterns, such as tessellations and sequences of shapes;**
- **measures angles, weights, capacities, times, and temperatures using appropriate units;**
- **chooses appropriate units of measure and converts with ease between like units, e.g., inches and miles, within a customary or metric system; note that conversions between customary and metric are not required;**
- **reasons proportionally in situations with similar figures;**
- **reasons proportionally with measurements to interpret maps and to make smaller and larger scale drawings;**
- **models situations geometrically to formulate and solve problems.**

Examples of performances that may demonstrate understanding include:

- drawing enlargements and reductions accurately to scale, e.g., cartoons to posters, a map of school or home;
- studying the steepness of wheelchair ramps and stairs *(see also Applied Learning Standard 1)*;
- investigating the area around the school and neighborhood to describe the size of an acre and a square mile;
- displaying data with an accurately drawn and divided pie chart;
- finding the minimum perimeter for a rectangle with an area of 25 square units, if dimensions are whole numbers; repeating the procedure for rectangles of areas 30, 35, 40; and figuring out how to predict the dimensions of the rectangle with minimum perimeter in continuing this investigation with larger whole numbers. *(see NCTM, Mathematics Teaching in the Middle School)*;
- making a two-dimensional, cardboard or paper replica of one's self using measurements of lengths and widths of body parts that are half those of one's own body *(see UCSMP, Transition Mathematics)*;
- examining logos of businesses in the yellow pages for rotational and bilateral symmetry.

3. Function and Algebra Concepts

This standard describes the foundation expected of middle school students in preparation for study of algebra in high school. Many students will take a course in algebra before high school, and their understanding of functions and algebra should surpass what is described below.

The student:

- **discovers, describes, and generalizes patterns, including linear, exponential, and simple quadratic relationships, i.e., those of the form $f(n)=n^2$ or $f(n)=cn^2$, for constant c, including $A=\pi r^2$, and represents them with variables and expressions;**
- **represents relationships with tables, graphs in the coordinate plane, and verbal or symbolic rules;**
- **analyzes tables, graphs, and rules to determine functional relationships;**
- **finds solutions for unknown quantities in linear equations and in simple equations and inequalities.**

Examples of performances that may demonstrate understanding include:

- developing in tabular, verbal, and algebraic form a function that shows how much money is earned as a function of time worked;
- graphing and explaining the growth of population over time of a colony of organisms that doubles once a day;
- using diagrams, tables, graphs, words, and formulas to show the relationships between the length of the sides of a square and its perimeter and area;
- studying the steepness of wheelchair ramps and stairs *(see also Applied Learning Standard 1)*;
- examining areas that can be enclosed by 24 feet of fencing and figuring out the maximum area;
- solving the following problem: Your principal wants to hire you to work for her for ten days. She will pay you either $6.00 each day for all ten days; or $1.00 the first day, $2.00 the second day, $3.00 the third day, and so on; or $0.10 the first day and each day thereafter twice the amount of the day before. In which way would you earn the most money? In which way would you earn the least money? *(see NCTM, Mathematics Teaching in the Middle School)*;
- investigating the following situation: Bricklayers use the rule $N=7LH$ to determine the number N of bricks needed to build a wall L feet long and H feet high. Examine a brick wall or portion of a brick wall to see whether this seems to be true. If it works, why? If not, what would be a better formula? *(see UCSMP, Transition Mathematics)*.

4. Statistics and Probability Concepts

The student:

- **collects and organizes data and displays data with appropriate tables, charts, and graphs;**
- **analyzes data with respect to characteristics of frequency and distribution, including mode and range;**
- **analyzes appropriately central tendencies of data with mean and median;**
- **makes conclusions and recommendations based on data analysis;**
- **critiques the conclusions and recommendations of others' statistics;**
- **considers effects on reliability of sampling procedures and of missing or incorrect information;**
- **formulates hypotheses to answer a question and uses data to test hypotheses;**
- **recognizes equally likely outcomes, constructs sample spaces, and determines probabilities of events;**
- **makes predictions based on experimental or theoretical probabilities;**
- **predicts the result of a series of trials once the probability for one trial is known.**

Examples of performances that may demonstrate understanding include:

- developing and analyzing games of chance for a school carnival *(see also Applied Learning Standard 1)*;
- displaying data with an accurately drawn and divided pie chart;
- deciding whether it is most advantageous to use three tetrahedra, two cubes, or one dodecahedron to arrive at a specific number when rolling polyhedral dice;
- gathering and analyzing data from the neighborhood and comparing the data with published statistics for the city, state, or nation *(see also Applied Learning Standard 1)*;
- using box-and-whiskers plots, stem-and-leaf plots, and bar graphs to compare characteristics of the boys and girls in the class; comparing the kinds of information provided by the different displays;
- solving the following problem: Your fifth grade cousin is convinced that the probability of rolling a 12 on two numbered cubes is 1/11. Explain to your cousin why this is incorrect, and convince your cousin of the actual probability of getting 12.

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5. Problem Solving and Mathematical Reasoning

The student solves problems that make significant demands in one or more of these aspects of the solution process: problem formulation, problem implementation, and problem conclusion.

Problem formulation

The student:

- formulates and solves a variety of meaningful problems;
- extracts pertinent information from situations and figures out what additional information is needed;
- formulates conjectures and argues, short of formal proof, why they must be or seem true.

Problem implementation

The student:

- uses and invents a variety of approaches and understands and evaluates those of others;
- invokes problem solving strategies, such as illustrating with sense making sketches to clarify situations or organizing information in a table;
- determines, where helpful, how to break a problem into simpler parts;
- solves for unknown or undecided quantities using algebra, graphing, sound reasoning, and other strategies;
- integrates concepts and techniques from different areas of mathematics;
- works effectively in teams when the nature of the task or the allotted time makes this an appropriate strategy;
- makes sensible, reasonable estimates;
- makes justified, logical statements.

Problem conclusion

The student:

- verifies and interprets results with respect to the original problem situation;
- generalizes solutions and strategies to new problem situations.

Examples of problem solving and reasoning include:

- analyzing advertisements for different music clubs and deciding which offers the best value for money;
- deciding whether it is most advantageous to use three tetrahedra, two cubes, or one dodecahedron to arrive at a specific number when rolling polyhedral dice;
- describing the size of a million of an object, e.g., a shoe box, a penny, a pack of notebook paper, and a millionth of that same object;
- making the following conjectures: What happens to the area of a square when you double its perimeter? What happens to the area when you triple its perimeter? Investigate to see if this is true and if so, explain why. What does doubling the circumference of a circle do to its area? Explain.
- solving the "locker problem": If, in a school of 1,000 lockers, one student opens every locker, another student closes every other locker (2^{nd}, 4^{th}, 6^{th}, etc.), a third student changes every third locker (opens closed lockers and closes open lockers), and so on, until the thousandth student changes the thousandth locker. Which lockers are open? Why?
- figuring out how long it would take to say your name a million times; how long it would take to count to a million.

6. Mathematical Skills and Tools

The student:

- computes accurately with arithmetic operations on rational numbers;
- knows and uses the correct order of operations for arithmetic computations;
- estimates numerically and spatially;
- measures length, area, volume, weight, time, and temperature accurately;
- refers to geometric shapes and terms correctly;
- uses equations, formulas, and simple algebraic notation appropriately;
- organizes data on charts and graphs, including scatter plots, bar, line, and circle graphs, and Venn diagrams;
- uses recall, mental computations, pencil and paper, measuring devices, mathematics texts, manipulatives, calculators, computers, and advice from peers, as appropriate, to achieve solutions.

Examples of mathematical skills and tools include:

- interpreting graphs and charts published in the newspaper;
- using the formula $A=\frac{1}{2}bh$ for areas of triangles measured with customary and metric rulers;
- analyzing advertisements for different music clubs and deciding which offers best value for money;
- making a two-dimensional, cardboard or paper replica of one's self using measurements of lengths and widths of body parts that are half those of one's own body *(see UCSMP Transition Mathematics)*;
- figuring out how to compute a 15%, 10%, or 20% tip, other than by multiplying an amount by 0.15, 0.1, or 0.2 on paper;
- figuring out how long it would take to say your name a million times; how long it would take to count to a million.

7. Mathematical Communication

The student:

- uses mathematical language and representations with appropriate accuracy, including numerical tables and equations, simple algebraic equations and formulas, charts, graphs, and diagrams;
- organizes work, explains facets of a solution orally and in writing, labels drawings, and uses other techniques to make meaning clear to the audience;
- uses mathematical language to make complex situations easier to understand;
- exhibits developing reasoning abilities by justifying statements and defending work;
- shows understanding of concepts by explaining ideas not only to teachers and assessors but to fellow students or younger children;
- comprehends mathematics from reading assignments and from other sources.

Examples of mathematical communication include:

- using diagrams, tables, graphs, words, and formulas to show the relationship of the length of the sides of a square to its perimeter and area;
- using symbols and a Cartesian map to explain to another student how to get from your home to school;
- gathering and analyzing data from the neighborhood and comparing the data with published statistics for the city, state, or nation;
- using box-and-whiskers plots, stem-and-leaf plots, and bar graphs to compare characteristics of the boys and girls in the class; comparing the kinds of information provided by the different displays;
- making the following conjectures: What happens to the area of a square when you double its perimeter? What happens to the area when you triple its perimeter? Investigate to see if this is true and if so, explain why. What does doubling the circumference of a circle do to its area? Explain.
- solving the following problem: Your fifth grade cousin is convinced that the probability of rolling a 12 on two numbered cubes is 1/11. Explain to your cousin why this is incorrect, and convince your cousin of the actual probability of getting 12.

8. Putting Mathematics to Work

The student conducts at least one large scale investigation or project each year drawn from the following kinds and, over the course of middle school, investigations or projects drawn from at least three of the kinds.

A single investigation or project may draw on more than one kind.

Data study based on civic, economic, or social issues, in which the student:

- selects an issue to investigate;
- makes a hypothesis on an expected finding;
- gathers data;
- analyzes the data using concepts from Standard 4, e.g., considering mean and median, and the frequency and distribution of the data;
- shows how the study's results compare with the hypothesis;
- uses pertinent statistics to summarize;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the findings.

Mathematical model of physical phenomena, often used in science studies, in which the student:

- carries out a study of a physical system using a mathematical representation of the structure;
- uses understanding from Standard 3, particularly with respect to the determination of the function governing behavior in the model;
- generalizes about the structure with a rule, i.e., a function, that clearly applies to the phenomenon and goes beyond statistical analysis of a pattern of numbers generated by the situation;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the findings.

Design of a physical structure, in which the student:

- generates a plan to build something of value, not necessarily monetary value;
- uses mathematics from Standard 2 to make the design realistic or appropriate, e.g., areas and volumes in general and of specific geometric shapes;
- summarizes the important features of the structure;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the findings.

Management and planning, in which the student:

- determines the needs, e.g., cost, supply, scheduling, of the event to be managed or planned;
- notes any constraints that will affect the plan;
- determines a plan;
- uses concepts from any of Standards 1 to 4, depending on the nature of the project;
- considers the possibility of a more efficient solution;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the plan.

Pure mathematics investigation, in which the student:

- extends or "plays with," as with mathematical puzzles, some mathematical feature, e.g., properties and patterns in numbers;
- uses concepts from any of Standards 1 to 4, e.g., an investigation of Pascal's triangle would have roots in Standard 1 but could tie in concepts from geometry, algebra, and probability; investigations of derivations of geometric formulas would be rooted in Standard 2 but could require algebra;
- determines and expresses generalizations from patterns;
- makes conjectures on apparent properties and argues, short of formal proof, why they seem true;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the findings.

Other kinds of projects putting mathematics to work chosen by student or teacher.

Examples of investigations or projects include:

- gathering and analyzing data from the neighborhood and comparing the data with published statistics for the city, state, or nation;
- comparing the growth of a set of plants under a variety of conditions, e.g., amount of water, fertilizer, duration and exposure to sunlight;
- designing and equipping a recreational area on one acre with a limited budget;
- analyzing and concocting games of chance for a school carnival;
- discovering relationships among and properties of the numbers in Pascal's triangle and reading to find more relationships and properties.

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Work Sample & Commentary: *Dart Board*

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Mathematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	Scientific Connections & Applications	Scientific Thinking	Scientific Tools & Technologies	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

The quotations from the Mathematics Performance Descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 32-33.

The task

Students were asked to respond to the following task: Design a dart board that has four regions with the following features:

score value	*probability %*
100 points	10%
50 points	20%
25 points	30%
10 points	40%

The dart board may be any shape (circle, square, etc.) and must have an area between 1,000 sq. cm and 3,000 sq. cm. Assume the probability is proportional to the area of the region. Make a scale drawing with dimensions and explain your solution in words.

Circumstances of performance

This "Problem of the Week" is an excerpt from a middle school student's portfolio.

Mathematics required by the task

The task calls for the student to set up a total area that satisfies given constraints. Then the student must partition this area correctly into regions of sizes proportional to the given percentages. The scale drawing requires understanding of appropriate measurement and proportional reasoning. A firm grasp of area measurement is needed for a successful solution.

Probability, while mentioned, is not actually called for by the task. The assumption equating the probability of hitting a region with the area of the region presumes that darts would always land on the board and that players' aim at the target would be ineffective.

Nevertheless, the task lends itself to a wide variety of solutions. Some approaches are quite involved and complex, calling for considerable care, thought, and skill. This student response exemplifies such an approach. Other satisfactory solutions might be less complicated. An example would be a choice of dart board as a 100 cm x 20 cm rectangle, divided along the length in 10, 20, 30, and 40 cm segments.

Mathematics evident in this student work

This student response provides evidence for a strong understanding of parts of Geometry and Measurement Concepts, including circles and annuli (rings), particularly area. Also demonstrated are accurate and appropriate uses of parts of Number and Operation Concepts, particularly percents, decimals, squares, and square roots. The student's systematic approach and sound interpretation of the constraints and quantities involved are evidence for parts of Problem Solving and Mathematical Reasoning. Mathematical Skills and Tools from Standard 6 are used effectively. The structure of the solution provides evidence for clear Mathematical Communication with the reader.

This work sample provides evidence for the quality of work expected for parts of the following Mathematics standards:

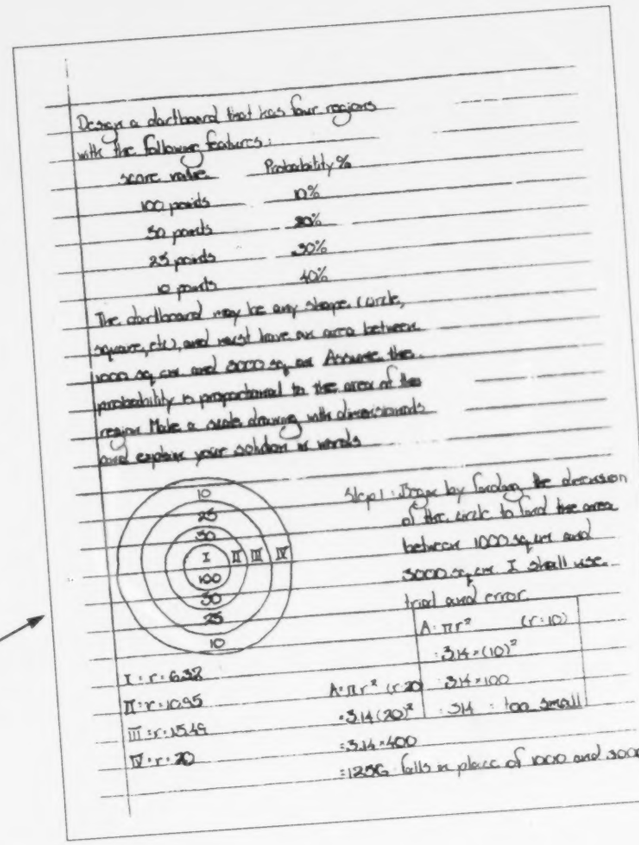
Standard 1, Number and Operation Concepts;
Standard 2, Geometry and Measurement Concepts;
Standard 5, Problem Solving and Mathematical Reasoning;
Standard 6, Mathematical Skills and Tools;
Standard 7, Mathematical Communication.

The dart board sketch is not a scale drawing. A well executed diagram would have provided strong evidence of proportional reasoning, part of the standard for Geometry and Measurement Concepts. Still, concentric circles are appropriate for the dart board design and the board fits the constraints posed by the task.

Geometry and Measurement Concepts

The student:

- **is familiar with assorted two- and three-dimensional objects, including…circles….**


Design a dartboard that has four regions with the following features:
score value
Probability %
100 points
10%
50 points
20%
25 points
30%
10 points
40%
The dartboard may be any shape (circle, square, etc), and must have an area between 1000 sq cm and 3000 sq cm. Assume the probability is proportional to the area of the region. Make a scale drawing with dimensions and explain your solution in words
Step 1: Begin by finding the dimension of the circle to find the area between 1000 square and 3000 square I shall use trial and error
I
II
III
IV
I : r = 6.38
II : r = 10.95
III : r = 15.45
IV : r = 20
A = πr² (r = 10)
= 3.14 (10)²
= 3.14 × 100
= 314 too small
A = πr² (r = 20)
= 3.14 (20)²
= 3.14 × 400
= 1256 falls in place of 1000 and 3000

Problem Solving and Mathematical Reasoning

Problem implementation

The student:

- **solves for unknown or undecided quantities using algebra, graphing, sound reasoning, and other strategies.**

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The organization of the student's work and of her strategy for addressing the task (breaking the larger task into smaller, manageable pieces) is a sign of skillful problem solving and good communication.

Problem Solving and Mathematical Reasoning

Problem implementation

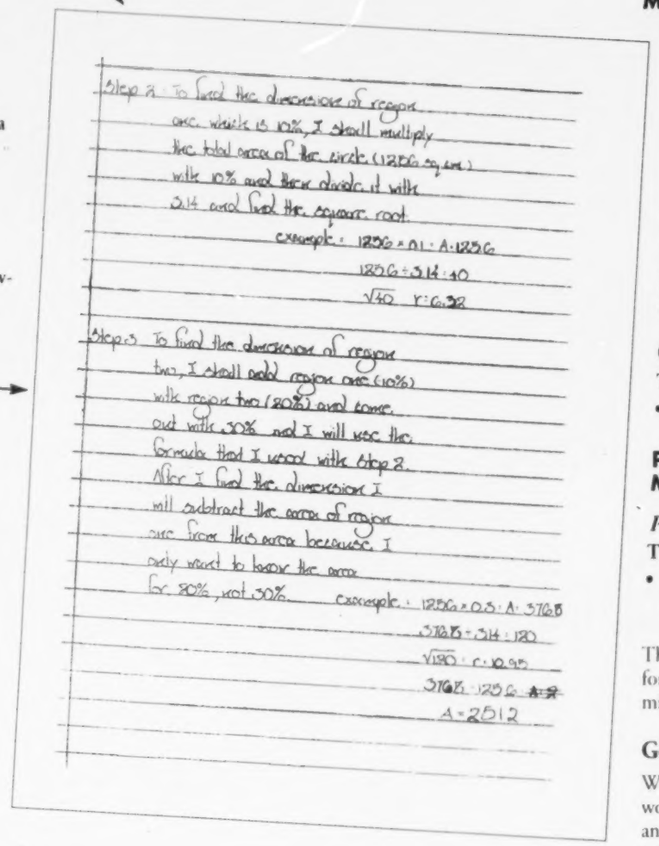
The student:

- **determines, where helpful, how to break a problem into simpler parts.**

Mathematical Communication

The student:

- **organizes work, explains facets of a solution orally and in writing, labels drawings, and uses other techniques to make meaning clear to the audience.**


Step 2 To find the dimension of region one, which is 10%, I shall multiply the total area of the circle (1256 sq cm) with 10% and then divide it with 3.14 and find the square root.
example: 1256 × .01 = A: 1256
1256 ÷ 3.14 = 40
√40 r: 6.32
Step 3 To find the dimension of region two, I shall add region one (10%) with region two (20%) and come out with 30% and I will use the formula that I used with step 2. After I find the dimension I will subtract the area of region one from this area because I only want to know the area for 20%, not 30%. example: 1256 × 0.3 = A: 376.8
376.8 ÷ 3.14 = 120
√120 r: 10.95
376.8 1256 A=?
A=251.2

Here, as in subsequent steps, the student appropriately applies the usual area formula for circles. She substitutes correctly, taking care to recognize that the area of the circle in her formula is the cumulative area of the regions at each step. Then she correctly uses the area formula to determine the appropriate radius. This illustrates the following parts of the standards:

Mathematical Skills and Tools

The student:

- **computes accurately with arithmetic operations on rational numbers;**
- **uses equations, formulas, and simple algebraic notation appropriately.**

Number and Operation Concepts

The student:

- **consistently and accurately…multiplies, and divides rational numbers;**
- **understands the inverse relationships between…multiplication and division, and exponentiation and root-extraction;**
- **interprets percent as part of 100;**
- **reasons proportionally.**

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Here, as elsewhere, the prose makes clear to the reader the means by which the student builds on the previous steps to determine the radius of the next dart board circle.

Mathematical Communication

The student:

- **organizes work, explains facets of a solution orally and in writing, labels drawings, and uses other techniques to make meaning clear to the audience.**

Here, as throughout, the student exhibits command of the concept of area, seemingly beyond just the area of circles and rings. This command accompanies her prowess with number and operation concepts.

Geometry and Measurement Concepts

The student:

- **understands…area.**

Problem Solving and Mathematical Reasoning

Problem implementation

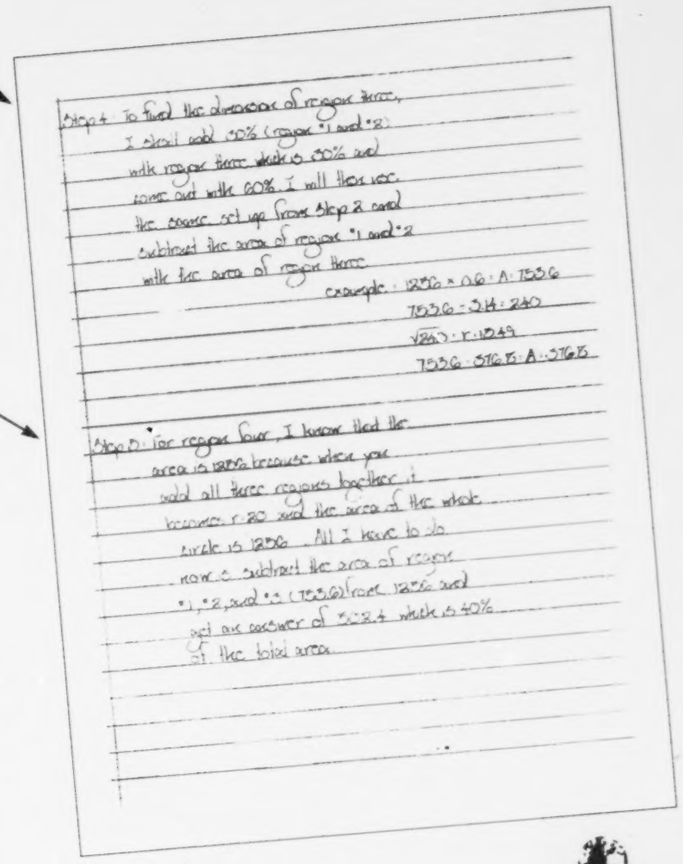
The student:

- **integrates concepts and techniques from different areas of mathematics.**

The cm unit is nowhere given as the unit of measure for the radius in the student's solution. This is fairly minor in the context of such an involved problem.

Going beyond

While this work provides evidence for the quality of work expected for parts of the standard for Geometry and Measurement Concepts, it is not sufficient evidence for the standard as a whole. The standard calls for understanding of measurement of geometric objects, but here the measure is area and the geometric objects are two-dimensional: circles and rings. Though no assessment will test every conceivable topic, it seems reasonable to expect that a middle school student will have some opportunity to convey knowledge of other shapes and properties of measurement in other dimensions.


Step 4 To find the dimension of region three, I shall add 30% (region 1 and 2) with region three which is 50% and come out with 80%. I will then use the square set up from Step 2 and subtract the area of region 1 and 2 with the area of region three
example: 1256 × .06 = A: 753.6
753.6 ÷ 3.14 = 240
√240 r: 15.49
753.6 376.8 A: 376.8
Step 5: for region four, I know that the area is 100% because when you add all three regions together it becomes r 20 and the area of the whole circle is 1256. All I have to do now is subtract the area of region 1, 2, and 3 (753.6) from 1256 and get an answer of 502.4 which is 40% of the total area.

More would also be needed to show a sufficiently broad range of understanding in the Geometry and Measurement Concepts domain. There was an opportunity provided by the task for the student to show understanding of proportional reasoning.

However, she either neglected to make a scale diagram of her dart board, or she attempted a scale drawing but did not execute it correctly. Other work in the portfolio calling for similar skills could provide the necessary evidence.

In the final year of lower secondary school in Japan, students are expected to "deepen their understanding of the characteristics of figures by using them: characteristics of a circle and a straight line, and characteristics of two circles; …similarity of simple figures, and the relationship between the ratios of length, areas, and volume in similar figures."

Course of Study for Lower Secondary Schools in Japan, p. 42.

Work Sample & Commentary: *Points and Segments*

1 Reading	2 Writing	3 Speaking, Listening & Viewing	4 Conventions, Grammar & Usage	5 Literature

English Language Arts

1 Number & Operation Concepts	2 Geometry & Measurement Concepts	3 **Function & Algebra Concepts**	4 Statistics & Probability Concepts	5 **Problem Solving & Mathematical Reasoning**	6 Mathematical Skills & Tools	7 **Mathematical Communication**	8 Putting Mathematics to Work

Mathematics

1 Physical Sciences Concepts	2 Life Sciences Concepts	3 Earth & Space Sciences Concepts	4 Scientific Connections & Applications	5 Scientific Thinking	6 Scientific Tools & Technologies	7 Scientific Communication	8 Scientific Investigation

Science

1 Problem Solving	2 Communication Tools & Techniques	3 Information Tech. Tools & Techniques	4 Learning & Self-mgmt. Tools & Techniques	5 Tools & Techniques for Working With Others

Applied Learning

The quotations from the Mathematics performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 32-33.

The task

Students were given the following task:
Connect all points with segments:

How many segments are needed to connect:
5 points? 6 points? 8 points? 10 points? 30 points? 100 points? n points?

[Students were then cued on how they might proceed:]
Make drawings for some of the above. Hints: Make a table. Look for patterns.

Circumstances of performance

This "Problem of the Week" appeared in a middle school student's portfolio.

Mathematics required by the task

The task called for students to explore a relationship (between numbers of points and connecting segments) and to recognize a pattern and generalize it. More specifically, in asking how many segments are needed to connect 100 points, then n points, the task invites a closed-form generalization, such as n(n-1)/2, instead of an open-ended form, such as 1 + 2 + 3 + 4 +…+ (n-1). The open-ended form is not well-suited for finding solutions with large values of n.

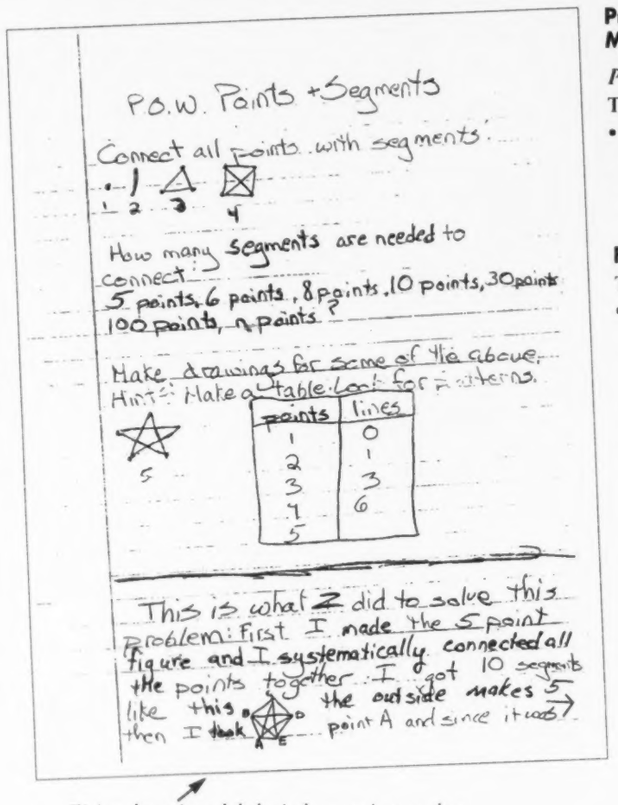
Other manifestations of this appealing problem are the popular "handshake problem" often posed to elementary children as well as the common formula for high school students new to the method of proof-by-induction, 1 + 2 + 3 + 4 +…+ (n-1) = n(n-1)/2 [or (n2-n)/2].

Mathematics evident in this student work

This student's work provides clear evidence for the strategies he used to tackle the problem and for the development of his solution in stages. The work provides strong evidence for parts of the standards for Problem Solving and Mathematical Reasoning, Mathematical Communication, and Function and Algebra Concepts. This response provides particularly strong evidence because the student's approach seems too unusual to have come from a teacher-led discussion of the problem.

This work sample provides evidence for the quality of work expected for parts of the following Mathematics standards:

Standard 3, Function and Algebra Concepts;
Standard 5, Problem Solving and Mathematical Reasoning;
Standard 7, Mathematical Communication.


P.O.W. Points + Segments
Connect all points with segments:
1 2 3 4
How many segments are needed to connect:
5 points, 6 points, 8 points, 10 points, 30 points
100 points, n points?
Make drawings for some of the above.
Hint: Make a table. Look for patterns.
5
points | lines
1 | 0
2 | 1
3 | 3
4 | 6
5
This is what I did to solve this Problem: First I made the 5 point figure and I systematically connected all the points together. I got 10 segments like this the outside makes 5
then I took point A and since it was
A
E

Giving the points alphabetical names is central to the clarity of the student's explanation.

Mathematical Communication

The student:

- **organizes work, explains facets of a solution orally and in writing, labels drawings, and uses other techniques to make meaning clear to the audience.**

The student's first two terms are n + (n-3), the same quantity as the first two terms of the more "classic" (n-1) + (n-2) +…+ 3 + 2 + 1.

Problem Solving and Mathematical Reasoning

Problem implementation

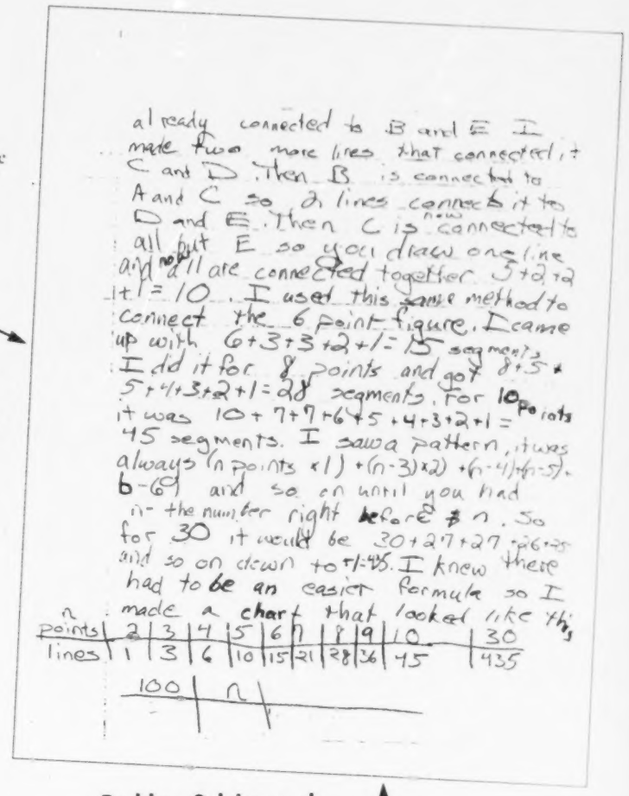
The student:

- **invokes problem solving strategies, such as illustrating with sense making sketches to clarify situations or organizing information in a table.**

Function and Algebra Concepts

The student:

- **represents relationships with tables, graphs in the coordinate plane, and verbal or symbolic rules.**


already connected to B and E I made two more lines that connected it C and D. then B is connected to A and C so 2 lines connects it to D and E. then C is now connected to all but E so you draw one line and all are connected together 5+2+2 +1=10. I used this same method to connect the 6 point figure. I came up with 6+3+3+2+1=15 segments I did it for 8 points and got 8+5+4+3+2+1=28 segments. for 10 points it was 10+9+8+7+6+5+4+3+2+1= 45 segments. I saw a pattern, it was always (n points x 1) +(n-3)x2) +(n-4)+(n-5)+ 6-6) and so on until you had in the number right before n. So for 30 it would be 30+27+27+26+ and so on down to +1-435. I knew there had to be an easier formula so I made a chart that looked like this
n | 2 | 3 | 4 | 5 | 6 | n | 8 | 9 | 10 | 30
points | 2 | 3 | 4 | 5 | 6 | n | 8 | 9 | 10 | 30
lines | 1 | 3 | 6 | 10 | 15 | 21 | 28 | 36 | 45 | 435
100 | n

Problem Solving and Mathematical Reasoning

Problem implementation

The student:

- **makes justified, logical statements.**

Function and Algebra Concepts

The student:

- **discovers, describes, and generalizes patterns…and represents them with variables and expressions.**

Mathematical Communication

The student:

- **uses mathematical language and representations with appropriate accuracy, including numerical tables.**

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Problem Solving and Mathematical Reasoning

Problem implementation

The student:

- **uses and invents a variety of approaches.**

The recognition, here, of the recurring increase of ½ in the fraction s/n (where s is the number of segments) is powerful. The student has gone beyond the recognition of simple quadratic functions such as $f(n)=n^2$ or $f(n)=cn^2$ and "reduced" a quadratic pattern to a linear pattern.

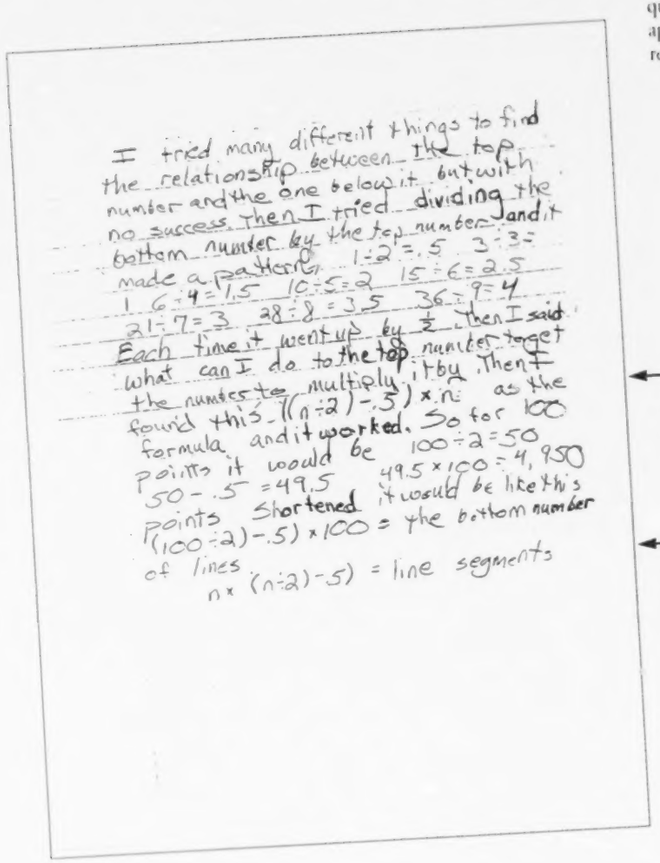
The work does not communicate well the reasoning used to conclude that s = ((n÷2) - .5) x n. For example, "Then I found this" leaves the reader to wonder, "How?"

Problem Solving and Mathematical Reasoning

Problem formulation

The student:

- **formulates conjectures.**



I tried many different things to find the relationship between the top number and the one below it, but with no success then I tried dividing the bottom number by the top number and it made a pattern 1÷2=.5 3÷3= 1.6÷4=1.5 10÷5=2 15÷6=2.5 21÷7=3 28÷8=3.5 36÷9=4 Each time it went up by ½ then I said what can I do to the top number to get the numbers to multiply it by. Then I found this ((n÷2)-.5) x n as the formula and it worked. So for 100 points it would be 100÷2=50 50-.5=49.5 49.5 x 100 = 4,950 points Shortened it would be like this (100÷2)-.5) x 100 = the bottom number of lines n x (n÷2)-.5) = line segments

Going beyond

This student's communication conveys his strategy and solution very well. To meet the standard for Mathematical Communication, it would need to be accompanied by additional work of comparable quality, such as work that exhibits correct and appropriate uses of multiple mathematical representations.

← Parentheses are repeatedly used incorrectly here, which does not detract from this solution but is worthy of correction for clearer communication.

← The student succeeds in expressing the number of segments as a function of the number of points.

Function and Algebra Concepts

The student:

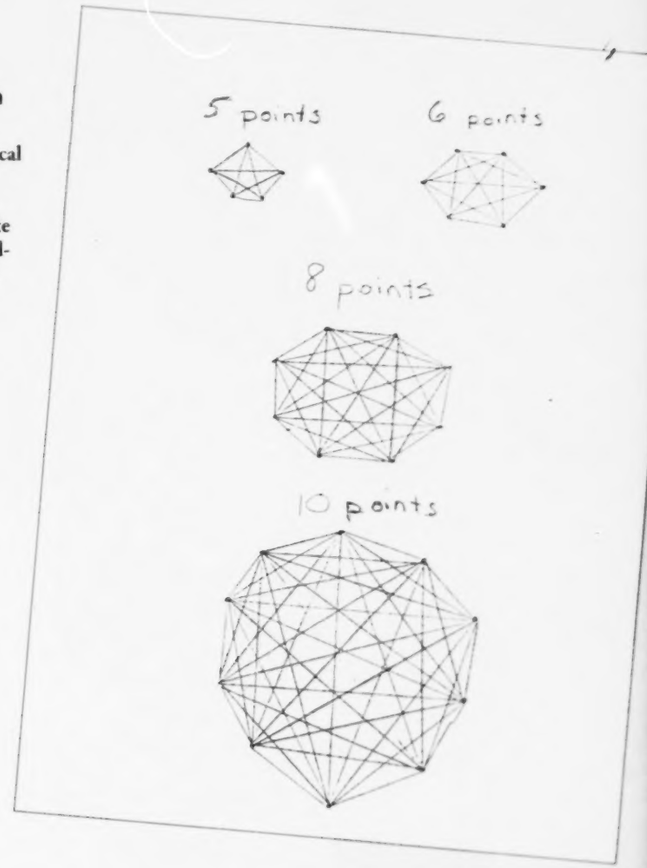
- **represents relationships with tables, graphs in the coordinate plane, and verbal or symbolic rules.**

This response also provides evidence for some parts of the standard for Function and Algebra Concepts. To say that the student has met the standard, however, this work would need to be accompanied by additional work of comparable quality demonstrating conceptual understanding, such as work with linear or exponential growth, perhaps involving the graphs of the functions.

Mathematical Communication

The student:

- **uses mathematical language and representations with appropriate accuracy, including…diagrams.**



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Work Sample & Commentary: *Probability Booth*

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	**Statistics & Probability Concepts**	**Problem Solving & Mathematical Reasoning**	Mathematical Skills & Tools	**Mathematical Communication**	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	Scientific Connections & Applications	Scientific Thinking	Scientific Tools & Technologies	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

The quotations from the Mathematics performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 32-33.

The task

Students were given the following task:
The parent/teacher association is organizing the annual fundraising carnival. The eighth grade class will be allocated one booth in which to conduct a fundraising activity. About 500 people usually attend this event.

Your task is to design an activity that uses multiple probability events and that would attract lots of players. In your plan, please explain why you think your activity would be fun to play, how much you would charge to play, how much you would pay a winning contestant, and how much profit you would expect to make from your activity. A team of students and parents will select the proposal they think would be the most successful.

Circumstances of performance

This is an unrevised draft of an in-class, individual timed assignment completed in 40 minutes.

Mathematics required by the task

The task called for students to design an "unfair" game, in which the organizers can be expected to make money. The game requires multiple probability events, which could be either independent or dependent events. The task includes a subjective criterion in requiring students to predict how many times the anticipated 500 attendees will play the game. Upon that assumption, students then needed to determine the expected payoff of the proposed game of chance.

The task is clear in stating the information required if the student understands "multiple probability events," yet it also leaves much freedom for the student to develop the problem, both in concocting the game and in predicting how many players the game will draw.

Mathematics evident in this student work

The work provides strong evidence for parts of Statistics and Probability Concepts. It provides evidence for determining probabilities of events, for example, the probabilities of coin tossing and dice throwing and of the multiple event created by combining the independent events into one game.

The work shows the student computing the profit he can expect at the booth, based on his assumptions about how many people will play. The student works within the constraints of the task to formulate his game of chance and predict the profits to be made. Thus, his work provides evidence for part of Problem Solving and Mathematical Reasoning. The solution is well-explained, providing evidence for the standard for Mathematical Communication.

This work sample provides evidence for the quality of work expected for parts of the following Mathematics standards:

Standard 4, Statistics and Probability Concepts;
Standard 5, Problem Solving and Mathematical Reasoning;
Standard 7, Mathematical Communication.

In his first two paragraphs, the student formulates the problem needing analysis by deciding on a game, a fee, and a prize, and by making a guess as to the number of people who will play.

Problem Solving and Mathematical Reasoning

Problem formulation

The student:

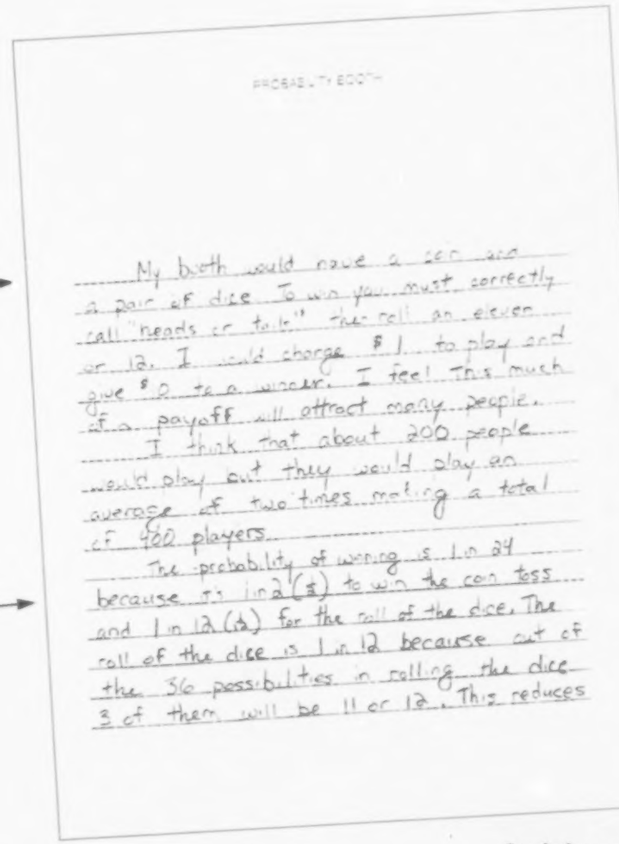
- **formulates and solves a variety of meaningful problems.**

The student is careful to clarify and justify his claim that P[rolling 11 or 12] = 1/12, by alluding to the sample space of 36 equally likely outcomes when tossing two dice.

Mathematical Communication

The student:

- **organizes work, explains facets of a solution orally and in writing, labels drawings, and uses other techniques to make meaning clear to the audience;**
- **exhibits developing reasoning abilities by justifying statements and defending work.**



PROBABILITY BOOTH

My booth would have a set up a pair of dice. To win you must correctly call "heads or tails" the roll an eleven or 12. I would charge $1 to play and give $2 to a winner. I feel This much of a payoff will attract many people.
I think that about 200 people would play but they would play an average of two times making a total of 400 players.
The probability of winning is 1 in 24 because it's 1 in 2 ($\frac{1}{2}$) to win the coin toss and 1 in 12 ($\frac{1}{12}$) for the roll of the dice. The roll of the dice is 1 in 12 because out of the 36 possibilities in rolling the dice 3 of them will be 11 or 12. This reduces

Statistics and Probability Concepts

The student:

- **recognizes equally likely outcomes, constructs sample spaces, and determines probabilities of events.**

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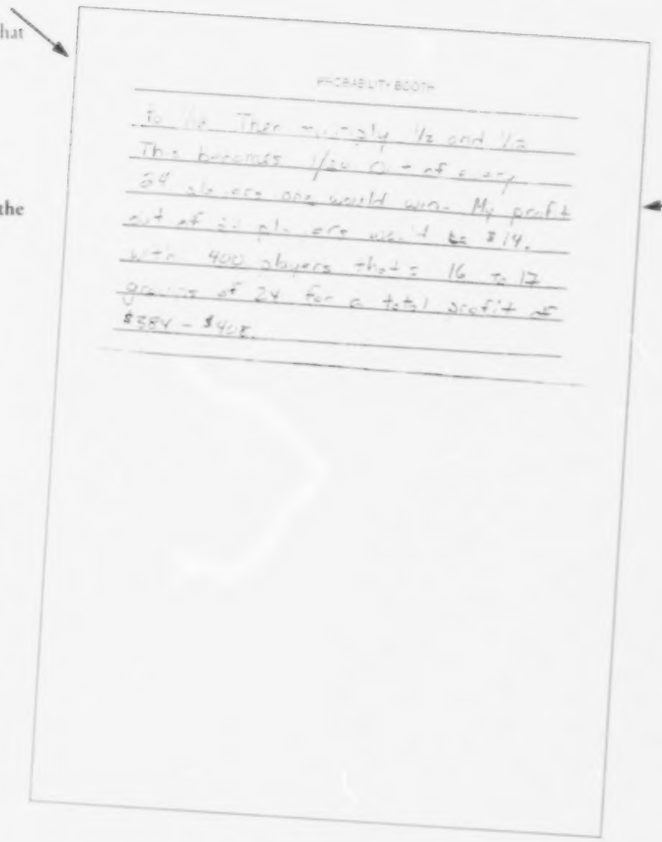
The student displays understanding of expected value, realizing that his 1/24 probability implies that he can expect one winner per 24 games played.

Statistics and Probability Concepts

The student:

- **makes predictions based on…theoretical probabilities;**
- **predicts the result of a series of trials, once the probability for one trial is known.**


PROBABILITY BOOTH

To be Then multiply ½ and ½

This becomes 1/24 or 4% of every

24 he ers one would win. My profit

out of 24 pl. ers will be $14.

with 400 players that's 16 to 17

groups of 24 for a total profit of

$384 - $408.

The student correctly notes that for each group of 24 players his expected profit is $14. Since a total of 400 players contains between 16 and 17 groups of 24, his expected profit should be between 16 x $14 = $224 and 17 x $14 = $238, so the range $224 to $238 should replace the student's response $384 to $408 (which is 16 x $24 and 17 x $24). This error does not detract from the evidence of understanding in the rest of the work.

One could challenge the assumption of 400 game players. Would that many really pay $1 for a chance to win $10 when the odds are so slim?

His reasoning is clear to the "expert" reader, his teacher, though it is sketchy towards the end with unexplained statements.

Going beyond

A good extension for this task would be to make conjectures about the numbers of game players when adjusting the values of either the prize money or the chances of winning. In this case, an optimization problem, based on the hypothesized numbers of players, manifests itself. The students' carnival choice could then be the one that would seem to yield maximum profit.

To say that the student has met the standard for Statistics and Probability Concepts, this work would need to be accompanied by work of comparable quality on statistics.

In Ontario, Canada, students can show proficient performance in the standard for Data Management and Probability by "identifying a question of personal interest or one related to a social issue and collecting, organizing, displaying, and analyzing data related to it; making use of available technology in collecting, organizing, displaying, and analyzing data; carrying out a probability experiment and drawing conclusions."

Provincial Standards: Mathematics, p. 53.

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Work Sample & Commentary: *Candle Life*

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	**Function & Algebra Concepts**	**Statistics & Probability Concepts**	Problem Solving & Mathematical Reasoning	**Mathematical Skills & Tools**	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	Scientific Connections & Applications	Scientific Thinking	**Scientific Tools & Technologies**	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

The quotations from the Mathematics performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 32-33.

The task

Students were given worksheets from *Algebra Experiments, Book 1: Exploring Linear Functions.* The worksheets directed students to write fractions and decimals and to use a linear relationship. The questions, while leading, are informative and instructional.

Circumstances of performance

The worksheets on Candle Life were given to students as homework.

Mathematics required by the task

The worksheets guide students through an experiment with analysis to determine a linear relationship between the volume of a container and the length of time a candle will burn when covered by it. To complete this experiment and answer the accompanying questions, students must gather, record, and graph data in the coordinate plane, determine an equation and characteristics of a line, and use the equation of the line to determine one coordinate of a point on the line given the other coordinate.

The task required algebra (linearity), interpretation of data gathered, and putting mathematics to work.

Mathematics evident in this student work

This student completes the experiment and answers most of the experiment's questions, using correctly the mathematics described above. In so doing, her work provides evidence for parts of the standards for Function and Algebra Concepts and for Statistics and Probability Concepts. The work provides evidence for broad use of Mathematical Skills and Tools.

This work sample provides evidence for the quality of work expected for parts of the following Mathematics standards:

Standard 3, Function and Algebra Concepts;
Standard 4, Statistics and Probability Concepts;
Standard 6, Mathematical Skills and Tools.

"Candle Life"

In my eighth grade algebra class, I performed an experiment to see if the time it took for a candle to extinguish was a function of how much air was in the glass container covering it. I gathered up twelve different containers of various sizes, a one-half inch food-warming candle, and a stopwatch. I lit the candle, placed the first container over it, and at the same time, started the stopwatch. At the moment the candle went out and I saw smoke, I stopped timing. I then repeated this procedure with the other eleven containers. Two more trials were done for each container. To measure the amount of air in each container, I filled them up with water and then poured it into a measuring cup marked in milliliters.

The data was graphed on a coordinate plane using the independent variable, x, as the size of the container used, and the dependent variable, y, as the time it took the candle to go out. The points I graphed formed a linear pattern. I drew a "line of best fit" and identified 2 points off of it. Using these points, I found the slope, y-intercept, and an equation for the line. The slope was 8/250, the y-intercept was 2, and the equation representing my data was y= 8/250x+2. This equation is a linear equation. The experiment showed that the time it took the candle to extinguish is a function of the volume of air surrounding it in an enclosed space.

The slope of my line, 8/250, means that for every 250 milliliters, it will take 8 seconds for the candle to extinguish. The y-intercept, 2, means that 2 seconds will be added for each trial.

From my "line of best fit" and the equation I formed from 2 points on it, I can predict the time it would take the candle to extinguish for any amount of air in a container.

Experiment 13

Candle Life

Equipment

food-warming candles, 1 per class or group

About one-half inch high and in an aluminum cup

stopwatches or a watch that displays seconds, 1 per class or group

glass containers of varying sizes (at least 6 different sizes of containers are needed)

Number the containers. Find at least 5 different sizes. Containers must be transparent and have flat tops so air cannot enter when they are inverted. Try medium-sized tumblers (about 10 oz.), vases, glass bowls, and carafes.

measuring cups

At least 2 cup size and marked in milliliters

water

graph paper, 1 sheet per student

Procedure

Light the candle. Have one student cover the bowl while the other activates the stopwatch. Stop timing when the flame is extinguished, or as the instant smoke appears. Repeat with at least 4 different containers.

The best value for this experiment will be the average of two trials for a given volume.

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This is a good interpretation of the slope of the line. The meaning ascribed to the y-intercept suffices only if detached from the scientific context of this task. The intercept is small (near zero) but it would be reasonable to expect the line to pass through the origin (0,0)—no volume, no time!

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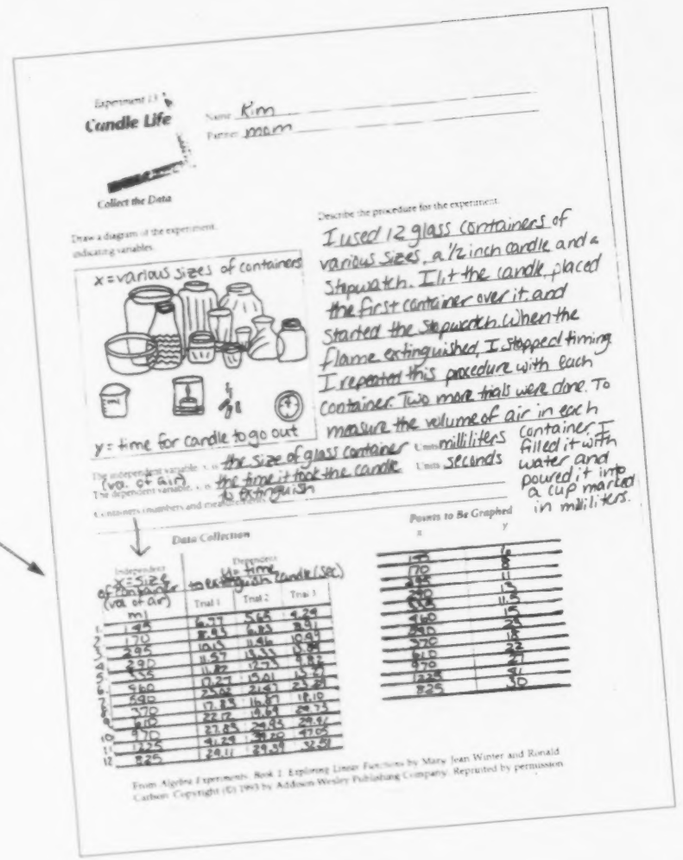
Because the air is at room temperature and standard pressure, measuring the air in ml is equivalent to measuring in cm^3.

After collecting her data over three trials for each container, the student determines the "time to extinguish [the] candle" by choosing the intermediate value from each set of three trials. She does not compute an exact average, as encouraged by the task. Instead she opts to approximate the time needed to extinguish the candle by choosing an integer between, and often close to, two of the three trial values. She does this for each container, with one curious exception. This method of choosing intermediate values for this specific task is as appropriate as the ones offered in the instructions.



Experiment 13
Candle Life
Name: Kim
Partner: mom

Collect the Data

Draw a diagram of the experiment, indicating variables.

x = various sizes of containers

y = time for candle to go out

Describe the procedure for the experiment.

I used 12 glass containers of various sizes, a 1/2 inch candle and a stopwatch. I lit the candle, placed the first container over it and started the stopwatch. When the flame extinguished, I stopped timing. I repeated this procedure with each container. Two more trials were done. To measure the volume of air in each container, I filled it with water and poured it into a cup marked in milliliters.

The independent variable, x, is the size of glass container (vol. of air)
Units: milliliters
The dependent variable, y, is the time it took the candle to extinguish
Units: seconds
Constants (numbers and conditions): 12 containers

Data Collection

	Independent: x = Size of glass container (vol. of air) ml	Dependent: y = time it took the candle (SEC) Trial 1	Trial 2	Trial 3
1	145	6.97	5.65	4.29
2	170	8.83	8.83	8.81
3	195	10.65	9.96	10.91
4	220	11.97	11.33	10.98
5	245	11.82	12.73	11.82
6	560	10.27	10.01	11.29
7	590	23.02	24.43	23.28
8	620	17.83	16.87	18.10
9	770	22.12	18.69	20.73
10	870	27.85	29.85	29.17
11	1025	41.23	39.20	41.05
12	825	29.11	29.59	32.29

Points to Be Graphed

x	y
145	6
170	8
195	11
220	11.5
245	12
560	15
590	23
620	18
770	22
870	29
1025	41
825	30

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Statistics and Probability Concepts

The student:

- **collects and organizes data and displays data with appropriate tables.**

Mathematical Skills and Tools

The student:

- **estimates numerically.**

The task's use of the phrase "best fit" is undefined here. Presumably, this phrase means "best fit to the naked eye," which is appropriate enough detail of this linear regression idea for middle school students.

She did not use two data points, as instructed, but her approach was sensible.

The determination of slope and y-intercept provides strong evidence that the student can manipulate algebraic expressions and equations of lines. It provides evidence as well of the following:

Mathematical Skills and Tools

The student:

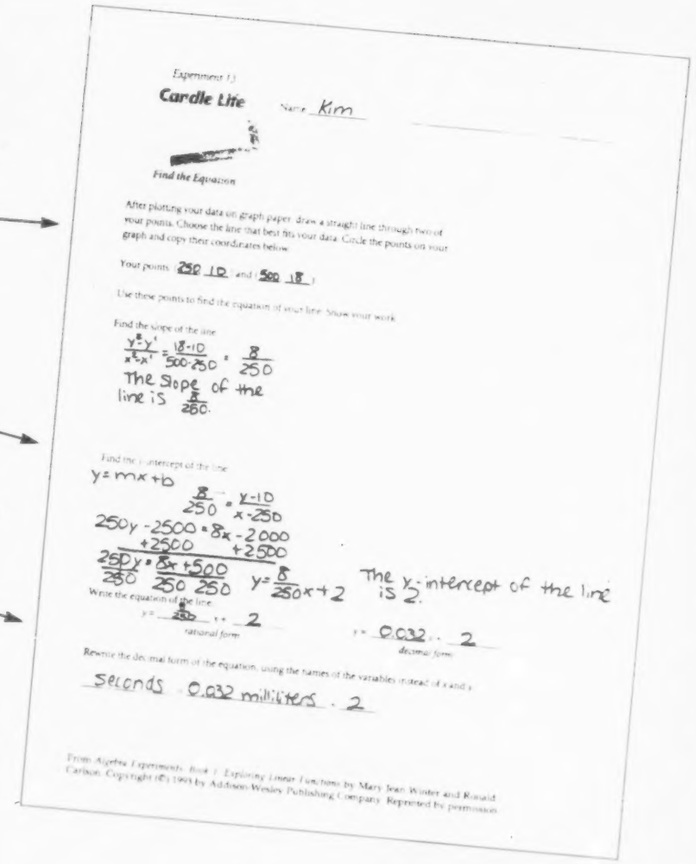
- **uses equations, formulas, and simple algebraic notation appropriately;**
- **computes accurately with arithmetic operations on rational numbers.**

Function and Algebra Concepts

The student:

- **represents relationships with…verbal or symbolic rules.**

In the data collection table, the student correctly assigned names and units of measurement to her independent and dependent variables. Here she incorrectly uses only units of measurement. A corrected entry would read something like this: "time (in sec.) = 0.032 · size (in ml) + 2."



Experiment 13
Candle Life
Name: Kim

Find the Equation

After plotting your data on graph paper, draw a straight line through two of your points. Choose the line that best fits your data. Circle the points on your graph and copy their coordinates below.

Your points: 250 10 and 500 18

Use these points to find the equation of your line. Show your work.

Find the slope of the line.

$\frac{y_2-y_1}{x_2-x_1} = \frac{18-10}{500-250} = \frac{8}{250}$

The slope of the line is $\frac{8}{250}$.

Find the y-intercept of the line.

$y = mx + b$

$\frac{8}{250} = \frac{x-10}{x-250}$

$250y - 2500 = 8x - 2000$

$+2500 \quad +2500$

$\frac{250y}{250} = \frac{8x+500}{250}$ $y = \frac{8}{250}x + 2$ The y-intercept of the line is 2.

Write the equation of the line.

$y = \frac{8}{250}x + 2$ (rational form)

$y = 0.032 \cdot 2$ (decimal form)

Rewrite the decimal form of the equation, using the names of the variables instead of x and y.

seconds = 0.032 milliliters · 2

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Science required by the task

The task consisted of an experiment in Mathematics class in which students tried to find a mathematical relationship between the amount of air in a jar and the length of time a candle will stay lit. Oxygen is a necessary component of combustion, yet it is not necessary for students to understand the process of combustion to complete the task. The mathematical analysis and applications required in the task draw on skills in Science Standard 6, Scientific Tools and Technologies.

Science evident in this student work

The student follows the instructions for gathering, graphing, and analyzing the data, consistent with expectations for Mathematics standards at the middle school level.

In two places, the student deviates from the instructions and uses data analysis techniques that are more common in Science than in Mathematics, i.e., taking a sensible midpoint in the data rather than an exact arithmetic average and taking points from the "best fit line" instead of actual data points. Such treatments of data, where measurements are not treated exactly but instead considered to be "plus or minus" by an error of measurement, are evidence of good technique at the middle school level for parts of Scientific Tools and Technologies. It should also be noted that the positive intercept has no physical meaning; given the context of an algebra exercise, failure to note this is not surprising.

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Work Sample & Commentary: *Candle Life* continued

1 Reading	2 Writing	3 Speaking, Listening & Viewing	4 Conventions, Grammar & Usage	5 Literature

English Language Arts

1 Number & Operation Concepts	2 Geometry & Measurement Concepts	**3 Function & Algebra Concepts**	**4 Statistics & Probability Concepts**	5 Problem Solving & Mathematical Reasoning	**6 Mathematical Skills & Tools**	7 Mathematical Communication	8 Putting Mathematics to Work

Mathematics

1 Physical Sciences Concepts	2 Life Sciences Concepts	3 Earth & Space Sciences Concepts	4 Scientific Connections & Applications	5 Scientific Thinking	**6 Scientific Tools & Technologies**	7 Scientific Communication	8 Scientific Investigation

Science

1 Problem Solving	2 Communication Tools & Techniques	3 Information Tech. Tools & Techniques	4 Learning & Self-mgmt. Tools & Techniques	5 Tools & Techniques for Working With Others

Applied Learning

Mathematical Skills and Tools

The student:

- **computes accurately with arithmetic operations on rational numbers;**
- **knows and uses the correct order of operations for arithmetic computations;**
- **uses equations, formulas, and simple algebraic notation appropriately.**

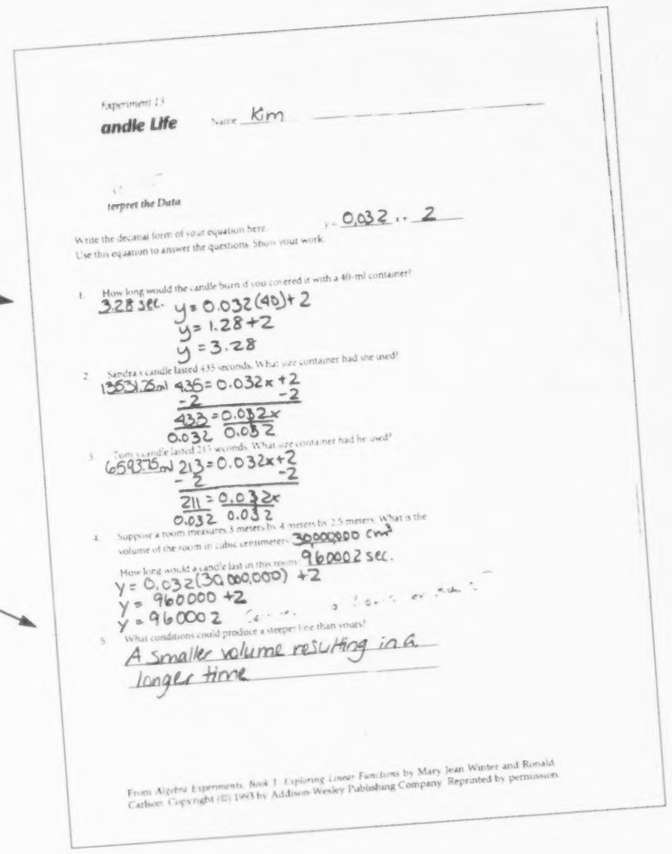
Function and Algebra Concepts

The student:

- **finds solutions for unknown quantities in linear equations.**

The 960,002 seconds are not appropriate units for this question. The student should convert this length of time into units that give the answer more meaning, e.g., "a little over 11 days."

The trouble with this claim is that smaller volumes will not result in longer times. The data already suggest specific extinguishment times for candles in covered spaces of small and large volumes.



Experiment 13

andle Life Name Kim

teepret the Data

Write the decimal form of your equation here. y = 0.032 x + 2
Use this equation to answer the questions. Show your work.

1. How long would the candle burn if you covered it with a 40-ml container?
328 sec. $y = 0.032(40) + 2$
$y = 1.28 + 2$
$y = 3.28$

2. Sandra's candle lasted 435 seconds. What size container had she used?
1353.75ml $435 = 0.032x + 2$
$-2 \quad -2$
$\frac{433}{0.032} = \frac{0.032x}{0.032}$

3. Tom's candle lasted 213 seconds. What size container had he used?
6593.75ml $213 = 0.032x + 2$
-2
$\frac{211}{0.032} = \frac{0.032x}{0.032}$

4. Suppose a room measures 3 meters by 4 meters by 2.5 meters. What is the volume of the room in cubic centimeters? 30,000,000 cm^3
How long would a candle last in this room? 960002 sec.
$y = 0.032(30,000,000) + 2$
$y = 960000 + 2$
$y = 960002$

5. What conditions could produce a steeper line than yours?
A smaller volume resulting in a longer time

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Statistics and Probability Concepts

The student:

- **collects and organizes data and displays data with appropriate…graphs.**

Mathematical Skills and Tools

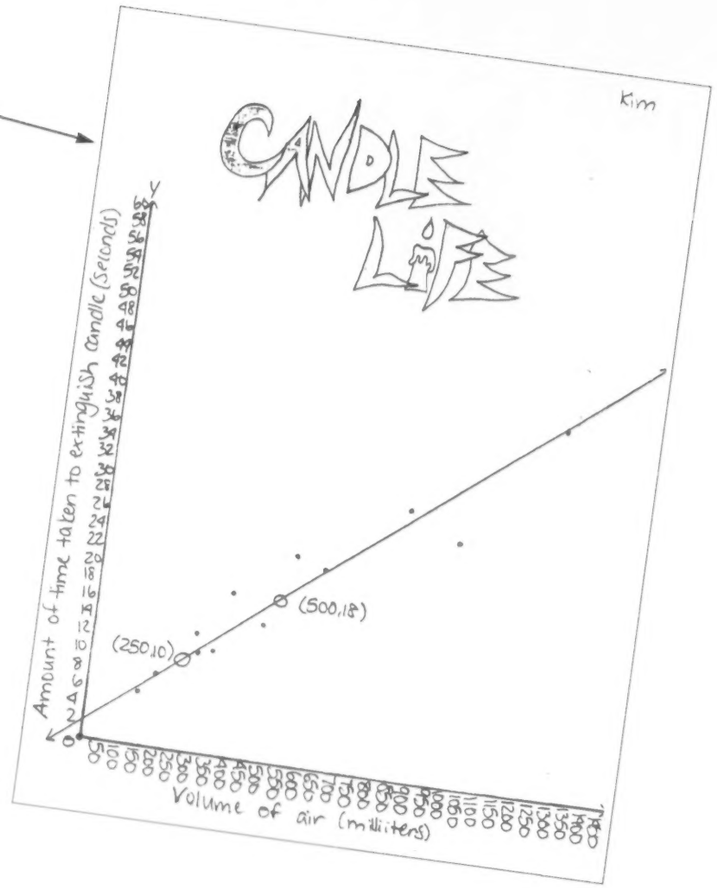
The student:

- **organizes data on charts and graphs, including scatter plots,…line graphs.**

Going beyond

This piece of work shows good execution of Function and Algebra Concepts—"represents relationships with...verbal or symbolic rules." To say that the student has met the standard for Function and Algebra Concepts, however, it would need to be complemented by work in which the student uses the data to select the appropriate functional relationship to provide evidence for the related aspect of the standard—"analyzes tables, graphs...to determine functional relationships."

Similarly, to say the student has met the standard for Statistics and Probability Concepts, the work would need to be accompanied by work of comparable quality showing that the student makes conclusions based on evidence.



Japanese students in middle schools are expected to "deepen their understanding of functional relationships and develop their ability to make full use of such knowledge: that some phenomena are described through the use of linear functions; that a linear equation with two variables is considered to express the functional relationship between the two variables."

Course of Study for Lower Secondary Schools in Japan, p. 39.

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Work Sample & Commentary: *A New Look on a Budget*

1 Reading	2 Writing	3 Speaking, Listening & Viewing	4 Conventions, Grammar & Usage	5 Literature

English Language Arts

1 Number & Operation Concepts	2 Geometry & Measurement Concepts	3 Function & Algebra Concepts	4 Statistics & Probability Concepts	5 Problem Solving & Mathematical Reasoning	6 Mathematical Skills & Tools	7 Mathematical Communication	8 Putting Mathematics to Work

Mathematics

1 Physical Sciences Concepts	2 Life Sciences Concepts	3 Earth & Space Sciences Concepts	4 Scientific Connections & Applications	5 Scientific Thinking	6 Scientific Tools & Technologies	7 Scientific Communication	8 Scientific Investigation

Science

1 Problem Solving	2 Communication Tools & Techniques	3 Information Tech. Tools & Techniques	4 Learning & Self-mgmt. Tools & Techniques	5 Tools & Techniques for Working With Others

Applied Learning

The quotations from the Mathematics performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 32-33.

The task

Students were given the following task:
Determine the cost of redecorating your room. You must carpet, paint two coats, and use wallpaper in some way. Draw to scale, on graph paper, each wall, including windows and doors.

Circumstances of performance

This was a long-term, individual project, to be completed primarily at home. Measuring instruments and calculators were allowed.

Mathematics required by the task

This planning project requires students to be skilled with one- and two-dimensional measurement and to compute quantities appropriately and accurately. Some formulation of the problem is necessary because students decide what information is needed when buying paint and when connecting that information to bedroom measurements. Students must also use proportional reasoning to make scale drawings of the redecorated space.

This project calls for skill with and understanding of two-dimensional measurement as well as numbers and operations. It can also lend itself to consideration of volume or use of optimization, e.g., minimizing cost.

Mathematics evident in this student work

This student work provides strong evidence for parts of Putting Mathematics to Work. The work also satisfies parts of the standard for Problem Solving and Mathematical Reasoning by formulating the problem of redecoration, imposing constraints not required by the task, and determining the information needed in order to proceed. The work then shows the student implementing the redecoration, in spirit if not in fact, by determining and making the appropriate measurements and calculations.

Command of the concept of area is evident, beyond simple multiplication of lengths times widths of rectangles. The work also shows elements of understanding of other parts of the standard for Geometry and Measurement Concepts. For example, the student converts between units of measurement, uses of units of appropriate size, and draws accurately to scale.

The many computations include manipulation of fractions and decimals and, to a lesser extent, percents. Repeatedly, the student computes with appropriate quantities and accurate measurements and calculations, providing evidence for parts of the standards for Number and Operation Concepts and Mathematical Skills and Tools.

This project description is organized and explained well enough to provide evidence for parts of the standard for Mathematical Communication.

This work sample provides evidence for the quality of work expected for parts of the following Mathematics standards:

Standard 1, Number and Operation Concepts;
Standard 2, Geometry and Measurement Concepts;
Standard 5, Problem Solving and Mathematical Reasoning;
Standard 6, Mathematical Skills and Tools;
Standard 7, Mathematical Communication;
Standard 8, Putting Mathematics to Work.

The student plans to redecorate her room and creates a realistic scenario with constraints of $700 and the added "twist" of being able to keep 50% of the remainder, which impacts the decisions to be made in ways that the $700 upper limit could not.

Putting Mathematics to Work

Management and planning, in which the student:

- **notes any constraints that will affect the plan;**
- **determines a plan.**

Problem Solving and Mathematical Reasoning

Problem formulation

The student:

- **formulates and solves…meaningful problems.**

Problem implementation

The student:

- **invokes problem solving strategies, such as…organizing information.**

A New Look
On a Budget

Problem

Determine the cost of redecorating your room. You must carpet, paint 2 coats, and use wallpaper in some way. Draw to scale, on graph paper, each wall, including windows and doors.

Solution

After being in the same old, boring room for four years, it was time to redecorate. I had been annoying my mom about it for almost a year when she finally relented. She agreed to let me redecorate my room only under certain circumstances. She gave me a $700 budget, but I had to do all of the figuring and calling. She also added that I could keep 50% of the remaining money, if there was any! After a few days of careful thought, I decided to take on this challenge.

I began my project by measuring each wall's dimensions carefully. I labeled the walls 1, 2, 3, and 4, so I could keep track of them. I measured the woodwork, doors, and windows separately because the woodwork and doors would be a different color. I found the area of each wall by multiplying its length times height. I did the same for the woodwork, doors and windows. I kept all of this figuring in a notebook because my mind will not hold all of those numbers.

Mathematical Skills and Tools

The student:

- **measures length, area,…accurately;**
- **uses…pencil and paper, measuring devices,…to achieve solutions.**

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The conversions between square inches, square feet, and square yards are correct and significant. Many students would incorrectly use divisors of 12 and 3 instead of 122 and 32 when converting.

Geometry and Measurement Concepts

The student:

- **understands length, area,...and the corresponding uses of units, square units...of measure;**
- **chooses appropriate units of measure and converts with ease between like units, e.g., inches and miles, within a customary or metric system.**

Some calculation is spared by the recognition that the opposite walls have equal sizes.

Number and Operation Concepts

The student:

- **consistently and accurately... multiplies...rational numbers.**

Mathematical Skills and Tools

The student:

- **computes accurately with arithmetic operations on rational numbers.**

Problem Solving and Mathematical Reasoning

Problem formulation

The student:

- **...figures out what additional information is needed.**

Putting Mathematics to Work

Management and planning, in which the student:

- **determines the needs...of the event to be...planned.**

Here is the measuring method I used: Using a yardstick, I measured the walls in yards and inches. Then I converted the yards to inches and found the total inches. To convert yards to inches, I multiplied the number of yards times 36. Next I multiplied on my calculator the length and height in inches to find the square inches of each wall. I divided the area by 144 to find the square feet. When necessary, I divided that by 9 to find the square yards. Because wall # 3 had a window, the area of the window was subtracted from the area of the wall. To find the area where I needed carpet, I multiplied the length of two walls that met at a 90 degree angle. I used the same process to find the area of the ceiling.

After doing what seemed like hours of figuring, I came up with my final figures. Wall #1 had 76 19/144 square feet of wall to be painted and 50 53/144 square feet of woodwork and doors to be painted. Wall #2 had 85 17/24 square feet of wall to be wallpapered and 5 1/24 square feet of woodwork to be painted. Wall #3 had 80 7/400 square feet of wall to be painted and 10 1/400 square feet of woodwork to be painted. Wall #4 had the same amount of square feet as wall #2 because it is parallel to wall #2 and has no extra woodwork, doors, or windows. Wall #4's 85 17/24 square feet of wall would be painted instead of wallpapered.

I went to _____ to help me with the proper amount of paint and paper to purchase. They said that 1 gallon of paint for regular walls would cover 400 square feet and 1 quart would cover 100 square feet. They also quoted the price of $14.99 for 1 gallon of wall paint tinted to be Classic Aqua. For the ceiling, I decided to use a cheaper type of

Though no mention is made, it seems that the student employs a calculator when rewriting her areas as decimals instead of mixed fractions. The numbers are too precise for this kind of work, however.

Number and Operation Concepts

The student:

- **consistently and accurately computes with, applies, and converts the different kinds and forms of rational numbers...written as decimals...or as...mixed fractions.**

Mathematical Skills and Tools

The student:

- **computes accurately with arithmetic operations on rational numbers;**
- **uses...pencil and paper,... calculators,...as appropriate, to achieve solutions.**

The decision to purchase one gallon and one quart of paint is well conceived and well explained.

Problem Solving and Mathematical Reasoning

Problem implementation

The student:

- **solves for unknown or undecided quantities using...sound reasoning.**

Putting Mathematics to Work:

Management and planning, in which the student:

- **considers the possibility of a more efficient solution.**

white paint that only cost $8.99. I also selected a roll of Ocean Scene wallpaper for wall #2.

Before I could purchase the paint and wallpaper, I had to be sure how much to purchase. Under normal circumstances, the paint company would take the measurements and advise me how much to buy. My mom insisted that I do that figuring. The total amount of wall space to be painted was 241.86 square feet. The salesperson recommended two coats, which meant I actually had 483.72 square feet to paint. One gallon covers on an average 400 square feet and one quart covers 100 square feet. It was obvious that 1 gallon was not enough and 2 gallons was too much, so I purchased 1 gallon and 1 quart. This amount of paint should cover 500 square feet. The ceiling was 168.6 square feet and 1 gallon will be sufficient for two coats of paint. The wall to be papered was 85 17/24 square feet. One roll of wallpaper covers 56 square feet. Two rolls would be required, which is fine since the paper was only sold in double rolls. The wall paint cost was $14.99 for 1 gallon and $5.99 for 1 quart. The wallpaper cost $31.98.

The next stop was _____. I found this store advertised in the paper. The advertised price for paint tools was cheaper than 2 other hardware stores advertised in the same paper. These same items were much more expensive at _____. The wood work and door surfaces to be painted were 70.45 square feet or 140.90 square feet allowing for the second coat of paint. I found I could not cover the surfaces with 1 quart and had to purchase 2 quarts. I bought 2 quarts of white woodwork paint for $11.98, a pan and paint roller kit for $5.49, and 2 paintbrushes for $4.90.

Teachers in France are asked to give "work that must allow the student to acquire a solid ability to use tools for measurement and drawing and to perform the basic operations in their heads and in writing; and, in conjunction with those abilities, to be able to use calculators to train themselves in deductive reasoning. Use of a computer ought to accompany these activities."

Colléges: Programmes et Instructions, p. 90.

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Work Sample & Commentary: *A New Look on a Budget* continued

1	2	3	4	5
Reading	**Writing**	Speaking, Listening & Viewing	**Conventions, Grammar & Usage**	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	**Geometry & Measurement Concepts**	Function & Algebra Concepts	Statistics & Probability Concepts	**Problem Solving & Mathematical Reasoning**	**Mathematical Skills & Tools**	**Mathematical Communication**	**Putting Mathematics to Work**

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	Scientific Connections & Applications	Scientific Thinking	Scientific Tools & Technologies	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

Number and Operation Concepts

The student:

- **consistently and accurately computes with…and converts the different kinds and forms of rational numbers…written as decimals, as percents;**
- **interprets percent as part of 100, and as a means of comparing quantities of…changing sizes.**

This summary of costs in an organized array is clearer than additional prose would have been. Such a display would also have been appropriate at other points in this report. The summary explains the total cost of the renovation, and the subsequent diagrams show the configuration of the redecorated room.

Mathematical Communication

The student:

- **organizes work…orally or in writing…to make meaning clear to the audience.**

Putting Mathematics to Work

Management and planning, in which the student:

- **prepares…an explanation of the plan.**

I ordered 19 square yards of Ivory Brilliant Saxony Carpet at _____ for $16.99 a square yard. The salesperson reminded me about the closet that needed to be carpeted in the same color as the room. I had to go home, measure the closet, and then call him with the additional information. It was 1.46 square yards. Because the store sells in whole yards, not fractions, the final order was for 21 square yards of carpet, costing $356.79. This price included installation and padding.

The total of all the purchases was $444.11. In Kentucky, tax is 6%. Six percent of $444.11 is $26.47. To calculate tax, I multiplied $444.11 times .06. When I added the tax, the grand total was $467.58. As stated earlier, my mom gave me a $700 budget. I was very pleased to find that I was $232.42 below budget. I received 50% of that, or $116.21. I used that to go on a class trip.

Supplies	Cost
1 gallon of Classic Aqua Paint	14.99
1 quart of Classic Aqua Paint	5.99
2 qt of white woodwork paint	11.98
1 double roll of Ocean Scene wallpaper	31.98
1 gallon of regular white paint	8.99
Pan & paint roller kit	5.49
2 paintbrushes	4.90
21 yd. of Ivory Brilliant Saxony Carpet	356.79
TOTAL	$444.11
TAX	$26.47
GRAND TOTAL	$467.58

Going beyond

Work with three-dimensional measurement could easily be included in or appended to this project. For example, because bedrooms normally include at least one bed, a dresser, and other items, volume and space considerations would arise.

This project provides evidence for Design of a physical structure, one of the kinds of investigation named in Standard 8, Putting Mathematics to Work.

This diagram is very accurately drawn to scale and well labeled for clarity. Though the computations are not shown, it is quite apparent that even though each unit of the graph paper represents one half-foot, conversions, e.g., 4 in. = ⅓ foot = ⅔ of one half-foot, were made so that the inches—fractions of feet—could be marked off with accuracy, according to scale.

Geometry and Measurement Concepts:

The student:

- **…converts with ease between like units…within a customary or metric system;**
- **reasons proportionally with measurements…to make…scale drawings.**

Number and Operation Concepts

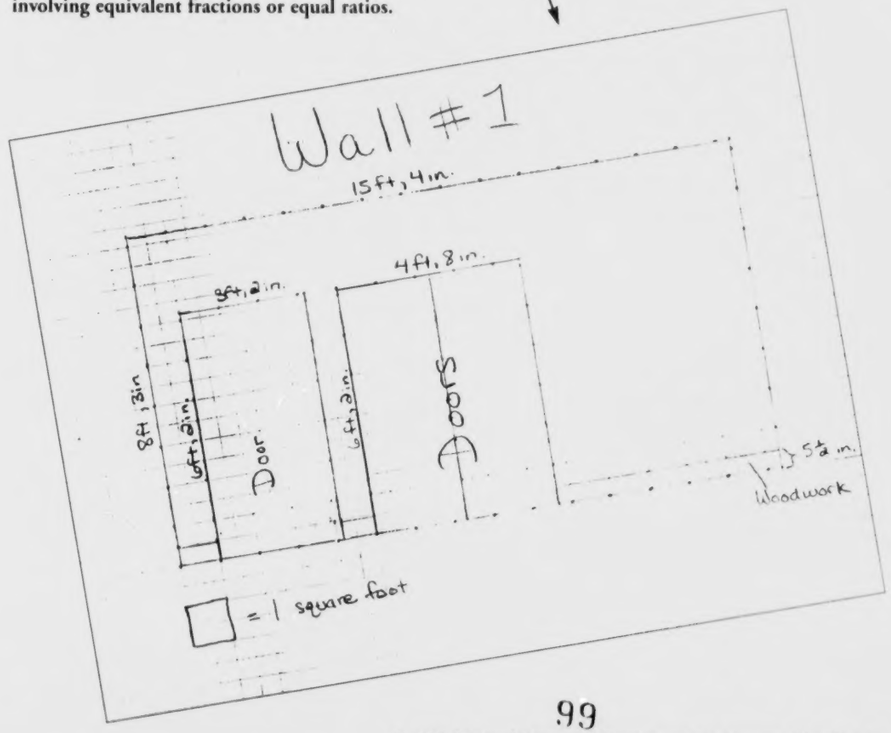
The student:

- **reasons proportionally to solve problems involving equivalent fractions or equal ratios.**

Mathematical Communication

The student:

- **uses mathematical language and representations with appropriate accuracy, including…diagrams;**
- **…labels drawings…to make meaning clear to the audience.**



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English Language Arts

This work sample provides evidence for the quality of work expected for the following parts of the English Language Arts standards:

Standard 2, Writing—produces a narrative procedure;
Standard 4, Conventions, Grammar, and Usage of the English Language—uses appropriate conventions.

Writing

The student produces:

A narrative procedure, in which the writer:

- **engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;**
- **provides a guide to action for a relatively complicated procedure in order to anticipate a reader's needs, creates expectations through predictable structures, e.g., headings, and provides smooth transitions between steps;**
- **makes use of appropriate writing strategies such as creating a visual hierarchy and using white space and graphics as appropriate;**
- **includes relevant information;**
- **excludes extraneous information;**
- **anticipates problems, mistakes, and misunderstandings that might arise for the reader.**

This work provides evidence that the student:

- engages the reader by establishing a context: redecorating a room on a budget;
- creates an engaging persona and maintains it throughout the piece, for example: "I had been annoying my mom…"; "I kept all this figuring in a notebook because my mind will not hold all of those numbers";
- anticipates the reader's needs and uses predictable structures to fulfill those needs, such as headings ("Problem", "Solution"), a list of supplies needed, a scale, and a series of scale drawings of the room to be redecorated;
- provides logical transitions for the procedure that give the writing a narrative quality, for example: "I began…"; "After doing what seemed like hours of figuring…"; "Before I could purchase the paint…"; "The next step…";
- provides clear examples and explanations, for example: "Here is the measuring method I used"; "It was obvious that 1 gallon was not enough and 2 gallons was too much, so I purchased 1 gallon and 1 quart"; "The salesperson reminded me about the closet that needed to be carpeted in the same color as the room";
- excludes extraneous information.

Conventions, Grammar, and Usage of the English Language

The student independently uses appropriate conventions of the English language, including:

- **spelling;**
- **sentence construction;**
- **paragraph structure;**
- **punctuation;**
- **grammar;**
- **usage.**

This work sample provides evidence that the student:

- manages the conventions, grammar, and usage of English so that they aid rather than interfere with reading. In this case, management of conventions includes consistency in the use of numbers.

In Australia, students at this level "control most distinguishing linguistic structures and features of basic text types such as stories, procedures, reports and arguments; evident when students, for example, adopt organizational conventions when given a structured format for writing a particular type of text (write a story with a setting, problem, events and a resolution; a play with a setting, characters, and dialogue; a report with a general introductory statement and information grouped under relevant headings; an explanation with a general statement, followed by a series of logical steps)."

English—a curriculum profile for Australian schools, p. 83.

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Samples of student work that help explain "how good is good enough" for these standards can be found immediately following these pages.

To see how these performance descriptions compare with expectations for elementary school and high school, turn to pages 90-97.

The Science standards are founded upon both the American Association for the Advancement of Science's Project 2061 *Benchmarks for Scientific Literacy* and the National Research Council's *National Science Education Standards draft*. The Science standards will also take into account the work of the National Science Teachers Association as they revise their *Scope, Sequence, and Coordination Content Core* and develop assessment tasks.

These documents, each of which runs to several hundred pages, contain detail that amplifies the meaning of the terms used here.

1. Physical Science Concepts

The student understands:

- **characteristic properties of matter, in particular, density; conservation of matter;**
- **motions and forces, and the relationships among them, for example, effects of unbalanced forces;**
- **transfer and transformations of energy, including forms and conversion.**

Examples of performances that may demonstrate understanding include:

- ▲ using the concept of density to explain why some things float and others sink in water;
- ▲ explaining the role and use of front and rear brakes on a bicycle;
- ▲ conducting an energy audit of the classroom and developing procedures for reducing waste *(see also Applied Learning Standard 1)*;
- ▲ building a grandfather clock and explaining how it works *(see also Applied Learning Standard 1)*;
- ▲ evaluating the claims and potential benefits of sunglasses that are advertised as screening out ultraviolet light;
- ▲ explaining the difference between recycling and reusing in terms of mass and energy conservation;
- ▲ explaining a Cartesian diver;
- ▲ earning the Auto Mechanics Merit Badge (Boy Scouts of America) or completing the Auto Maintenance Project (Girl Scouts of America) and explaining how it helped you to understand a physical sciences concept *(see also Applied Learning Standard 1)*.

2. Life Sciences Concepts

The student understands:

- **structure and function of cells, tissues, and organs;**
- **reproduction and heredity, including genes, traits, and learning;**
- **regulation and behavior, especially the roles of senses and hormones;**
- **population and ecosystems, including food webs, resources, and energy;**
- **evolution, in particular, species, diversity and adaptation, variation, extinction.**

Examples of performances that may demonstrate understanding include:

- ▲ explaining sneezes, tears, or what happens when you laugh;
- ▲ writing a story about how you or a person you know learned to overcome an inherited physical limitation;
- ▲ identifying a pest in the immediate environment; using an understanding of a food web to propose and test a way to eliminate the pest without introducing poisons;
- ▲ explaining the lines of evidence showing that dogs and cats are related by common ancestors;
- ▲ predicting how long a plant will live planted in moist soil in a closed glass jar located by a window; telling what additional information would be needed to make a better prediction *(see the National Research Council draft)*;
- ▲ earning the Bird Study Merit Badge (Boy Scouts of America) or completing the Plant Culture Project (Girl Scouts of America) and explaining how it helped you to understand a life sciences concept.

3. Earth and Space Sciences Concepts

The student understands:

- **Earth's systems, including crustal plates and land forms; rock cycle, water cycle; weather and oceans;**
- **Earth's history, especially change over time, erosion, movement of plates, fossil evidence;**
- **Earth in the Solar System, including day, year; sun, planet; gravity, energy;**
- **natural resource management.**

Examples of performances that may demonstrate understanding include:

- ▲ explaining why earthquakes, volcanoes, and sea-floor spreading have a common cause;
- ▲ writing a story about the experiences of a water molecule as it travels the globe;
- ▲ predicting what happens to the reading on a bathroom scale while riding in an elevator and explaining your observations;
- ▲ using the concept of gravity to explain why people can jump higher on the Moon than they can on Earth;
- ▲ developing an algorithm to tell whether the Moon is waxing or waning;
- ▲ completing the Geology Project (Girl Scouts of America) or earning the Astronomy Merit Badge (Boy Scouts of America) and explaining how it helped you to understand an Earth sciences concept.

4. Scientific Connections and Applications

The student understands:

- **big ideas and unifying concepts; for example, order and organization, models, systems, evolution and equilibrium, form and function, cause and effect, constancy and change;**
- **technology, including tradeoffs, constraints, feedback, risk;**
- **the designed world, including agriculture and industry;**
- **health, especially nutrition, exercise, and disease; toxic substances; safety; relationships with the environment;**
- **historical and contemporary impact of science.**

Examples of performances that may demonstrate understanding include:

- ▲ modifying the school's fire warning system for students with disabilities;
- ▲ analyzing an automatic ice maker and explaining how its design takes into account the differences in the properties of water in liquid and solid states;
- ▲ identifying a pest in the immediate environment; using an understanding of a food web to propose and test a way to eliminate the pest without introducing poisons;
- ▲ explaining why people who have colds should wash their hands when preparing food;
- ▲ creating a guide for a track team that travels around North America, to help them adjust to altitudes different from the place where they usually train;
- ▲ making recommendations to school officials about water quality on and near the campus *(see also Applied Learning Standard 1)*.

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5. Scientific Thinking

The student uses scientific reasoning strategies, scientific knowledge, and common sense to formulate questions about, understand, and explain a wide range of phenomena; that is, the student:

- **frames questions so that causes and effects can be distinguished; identifies variables that influence a situation and can be controlled;**
- **uses concepts from Standards 1 to 4 to explain a variety of observations and phenomena;**
- **uses evidence to develop descriptions, explanations, and models;**
- **proposes, recognizes, analyzes, considers, and critiques alternative explanations; distinguishes between fact and opinion;**
- **identifies problems; proposes and implements solutions; evaluates products or designs;**
- **works individually and in teams to collect and share information and ideas.**

Examples of scientific thinking include:

- ▲ predicting how long a plant will live planted in moist soil in a closed glass jar located by a window; telling what additional information would be needed to make a better prediction *(see the National Research Council draft);*
- ▲ determining if evidence in the summary data chart in Consumer Reports substantiates recommendations about the "Best Buy" for something you want to purchase;
- ▲ investigating the effect of a variable on plant growth, e.g., soil, water, light, size of container;
- ▲ evaluating the claims and potential benefits of sunglasses that are advertised as screening out ultraviolet light.

6. Scientific Tools and Technologies

The student uses tools and technologies to collect and analyze data; that is, the student:

- **uses a variety of traditional and electronic tools to directly, indirectly, and remotely observe and measure objects, organisms, and phenomena;**
- **records and stores data in a variety of formats, including databases, audiotapes, and videotapes;**
- **analyzes data while alert to observer and sample biases, using concepts and skills from Mathematics Standard 4, Statistics and Probability Concepts;**
- **acquires information from print, electronic, and visual sources, including computer databases.**

Examples of using scientific tools and technologies include:

- ▲ comparing the distribution of birds near the school with a field guide for the region;
- ▲ using a microcomputer based laboratory to compare the rates at which different carbonated beverages in a variety of containers loose their fizz;
- ▲ comparing the accuracy and timeliness of local weather information from a variety of sources;
- ▲ exchanging data on acid rain with students from other states and countries;
- ▲ using electronic databases to get current information on the health effects of long term space travel;
- ▲ completing the Animal Observation Project (Girl Scouts of America) and teaching another student how to conduct field observations.

7. Scientific Communication

The student communicates clearly and effectively about the natural world; that is, the student:

- **represents data and results in multiple ways; for example, numbers and statistics; drawings, diagrams, and pictures; sentences; charts and tables; models;**
- **argues from evidence, including his or her own data and the data of others;**
- **critiques published materials;**
- **explains a scientific concept or procedure to other students;**
- **communicates in a form suited to the purpose and the audience; responds to critical comments with data.**

Examples of scientific communication include:

- ▲ making recommendations to school officials about water quality on and near the campus;
- ▲ critiquing a USA Today article which reports that eating hot dogs in childhood causes adult leukemia;
- ▲ writing an advertisement for a hair care product that explains how it works;
- ▲ analyzing a ballot initiative on toxic chemicals;
- ▲ comparing the accuracy and timeliness of local weather information from a variety of sources;
- ▲ writing a review of Beakman's World;
- ▲ earning the Drafting Merit Badge (Boy Scouts of America).

8. Scientific Investigation

The student completes projects drawn from the following kinds of investigation, including at least one full investigation each year and, over the course of middle school, investigations representing all four kinds.

- **Controlled experiment;**
- **Fieldwork;**
- **Design;**
- **Secondary research; that is, use of others' data.**

A single project may draw on more than one kind of investigation.

A full investigation includes:

- **questions that can be studied using the resources available;**
- **procedures that are safe, humane, and ethical; respect privacy and property rights;**
- **data that have been collected and recorded *(see also Science Standard 6)* in ways that others can verify, and analyzed using skills expected at this grade level *(see also Mathematics Standard 4);***
- **data and results that have been represented *(see also Science Standard 7)* in ways that fit the context;**
- **recommendations, decisions, and conclusions based on evidence;**
- **acknowledgment of references and contributions of others;**
- **results that are communicated appropriately to audiences;**
- **reflection and defense of conclusions and recommendations from other sources and peer review.**

Examples of scientific investigations include:

- ▲ analyzing de-icers for relative effectiveness, cost, and environmental harm;
- ▲ researching local climate changes over the last century;
- ▲ studying different methods for cooking chicken in relation to health and aesthetics;
- ▲ making recommendations to school officials about water quality on and near the campus;
- ▲ adopting a stream and using that location to study water and habitat quality over time;
- ▲ conducting a field study at a local cemetery of monument degradation over time.

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Work Sample & Commentary: *Buoyancy*

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Math ematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	Scientific Connections & Applications	Scientific Thinking	Scientific Tools & Technologies	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

The quotations from the Science performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 48-49.

Science required by the task

Students who had been studying buoyant forces with vessels were asked to show what would happen to a tennis ball dropped from a height of 100 feet into 30 feet of water. The task asks for evidence of understanding unbalanced and balanced forces, a part of Standard 1, Physical Sciences Concepts.

Science evident in this student work

The work demonstrates a clear understanding of balanced forces, a challenging physical sciences concept at the middle school level. It also shows that the use of a diagram can be an effective way of demonstrating conceptual understanding.

Physical Sciences Concepts

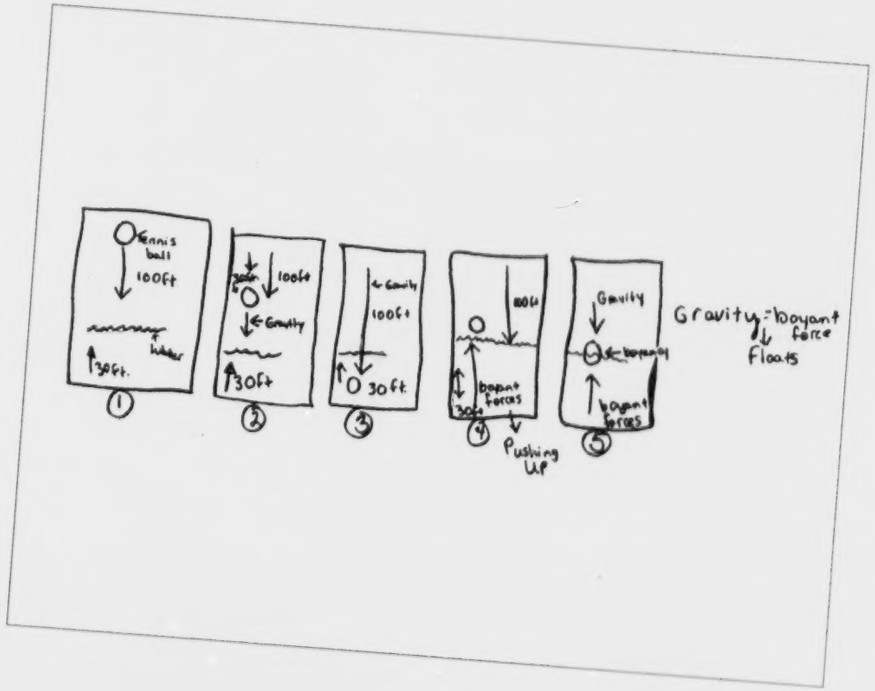
The storyboard provides evidence for an understanding of:

- **motions and forces, and the relationships among them, for example, the effects of unbalanced forces.**

The student analyzes the movement of the falling ball, seemingly a single action. Thus, the student shows that the forces acting upon this moving object are constantly changing, a physical sciences concept. In the first four frames, the arrow lengths depict the forces acting upon the ball as unbalanced. The ball is either beneath the water or above the water. In the final frame (frame number 5), the arrows for gravity and buoyancy are of equal length. The ball is depicted as floating, demonstrating that when the force of gravity is equal to the force of buoyancy, an object will float. Note that the length of the arrows depicting the force of gravity should be constant across all frames, so there may be a confusion between gravity and velocity. While the arrow depicting buoyancy appears to be acting outside the water in frame number 4, this misconception is not unusual for a middle school student. The evidence for conceptual understanding of balanced forces, however, is confirmed in the final frame by the statement: "Gravity = buoyant force —> floats."

Going beyond

Work of similar quality demonstrating understanding of properties of matter and of transfer and transformations of energy would be needed to round out the evidence of understanding Physical Sciences Concepts.



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Work Sample & Commentary: *Light Reflection*

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Mathematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	Scientific Connections & Applications	**Scientific Thinking**	**Scientific Tools & Technologies**	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

Science required by the task

The National Science Research Center encourages the establishment of student research centers in schools in the United States and around the world. The Center facilitates the exchange of information by publishing a journal of student investigations and by use of the Internet (nsrcmms@aol.com). It provides a standard format that students use to report their results. The format requires that students state a purpose and hypothesis; report their methods, data analysis, and conclusions; and suggest applications for their results. Students who use this format are therefore required to produce work related to parts of the following standards:

Standard 5, Scientific Thinking;
Standard 6, Scientific Tools and Technologies.

Science evident in this student work

This student chose to study the reflection of light on a smooth surface. This investigation therefore adds to the components required by the format evidence for conceptual understanding of the following part of:

Standard 1, Physical Sciences Concepts—transfer and transformations of energy, including forms and conversion.

Scientific Thinking

There are many concepts in the physical sciences that students are expected to accept at face value. Many students find it necessary to experiment directly and to confirm for themselves things that are already "known." This experimentation is part of Scientific Thinking: "distinguishes fact from opinion"; questioning "known facts" is an important part of Scientific Thinking at the middle school level.

Scientific Tools and Technologies

The somewhat complex method for gathering data is well designed to yield accurate measurements, one of the components of Scientific Tools and Technologies.

Physical Sciences Concepts

This work is limited to a single but important concept. This work provides evidence for understanding of the fact that light is reflected off smooth surfaces; that there is regularity to that process; and that there is a way to state the quantitative nature of the relationship between the "in-going" and "out-going" angles.

Going beyond

This work is a clear illustration of the quality of work expected for Physical Sciences Concepts. To meet the standard, however, it would need to be accompanied by work of comparable quality with motions and forces and with different forms of energy. Similarly, additional evidence of comparable quality of other aspects of Scientific Thinking and Scientific Tools and Technologies would be required to meet these standards.

TITLE: The Reflection of Light

I STATEMENT OF PURPOSE AND HYPOTHESIS:

I would like to do a scientific research project on the concept that light waves reflect off smooth surfaces at the same angle they hit them. I want to see if this is true. My hypothesis states that light waves do reflect off smooth surfaces at the same angle they hit them.

II. METHODOLOGY:

First, I wrote my statement of purpose. Then I wrote my review of literature. Next, I developed my hypothesis. Then I wrote my methodology. Next, I wrote my list of materials. Then I developed my observation and data collection form. Next, I began my experimentation, observation, and data collection. I did my experimentation by covering the lens of a flashlight with a black piece of paper. I then cut a hole at the edge of the paper so that only one ray of light could escape. Then I put a white piece of paper on the floor and put the mirror's edge on the paper so that a right angle was made. I laid the flashlight down on the white paper with the hole on the black paper covering the lens next to the floor. I set the flashlight at several angles to the mirror on the floor. Then I shined the flashlight at the mirror. I drew a line on the white paper following the ray hitting the mirror and the ray reflecting from the mirror. I then drew a line running perpendicular to the mirror from the vertex of the angle which the lines made and used a protractor to measure the two angles created. I repeated this procedure for each angle. Then I wrote my analysis of data. Next, I wrote my summary and conclusions where I accepted or rejected my hypothesis. Then I applied my findings to the real world. Last, I sent my abstract to the national journal of student research.

III. ANALYSIS OF DATA

I found that the in-going and out-going rays of light had the same angle. For the first trial, I shined the flashlight at the mirror at a 29 degree angle and the light reflected off at a 29 degree angle. For the second trial, I shined the flashlight at the mirror at a ten degree angle and the light reflected off at a ten degree angle. For the third trial, I shined the flashlight at the mirror at a 19 degree angle and the light reflected off at a 19 degree angle.

IV. SUMMARY AND CONCLUSIONS

My research indicates, that light reflects off smooth surfaces at the same angle it hits them. Therefore, I accept my hypothesis which states that light waves do reflect off smooth surfaces at the same angle they hit.

V. APPLICATION:

I will use my new knowledge to rearrange the mirrors in my room so that it will be brighter inside.

The quotations from the Science performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 48-49.

This piece of work comes from a project in which students share their work on the Internet. The General Accounting Office recently reported that more than half of 10,000 schools surveyed lacked modems and phone lines, and that only 35% of schools and 3% of classrooms currently have access to the Internet. We know this is an equity issue—that far more than 3% of the homes in the United States have access to the Internet and that schools must make sure that students' access to information and ideas does not depend on what they get at home. We have intentionally used this example to make the point that Standard 6, Scientific Tools and Technologies, includes using telecommunications to acquire and share information. New Standards' partners have pledged to create the learning environments where students can develop the knowledge and skills delineated here.

In Norway, "Observations and Experiment" is one of the main areas of study for middle school students, because "collection of data through observations and use of measuring instruments is an important part of the natural sciences. Such skills are also important in everyday life and at work. It is natural to include weighing and measuring using household equipment. In the natural sciences, it is often necessary to collect information systematically by means of tests and experiments, and use this information as a basis for later conclusions. This method should be used in all parts of Natural Science teaching. The pupils should themselves be allowed to formulate problems which they can investigate by means of simple experiments. They should also be able to assess the accuracy of the measurements and observations, and must consider whether their conclusions are sensible and valid."

Curriculum Guidelines for Compulsory Education in Norway, p. 266.

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Work Sample & Commentary: *Cruise Boats*

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Math ematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	**Scientific Connections & Applications**	Scientific Thinking	Scientific Tools & Technologies	**Scientific Communication**	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

The quotations from the Science performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 48-49.

Science required by the task

The task asked students to explain how cruise boats move. It was part of a unit in which the students studied motions and forces.

The task further asked students to explain the concepts at a level that could be understood by five- to ten-year-old children, and it limited the explanation to one page front and back. Students worked alone. It is not clear whether they were given opportunities for revision.

The task's context of a liquid medium may have been confusing to the student. For a middle school student, it is somewhat advanced to understand that the same laws of motion apply in both gas and liquid environments (with forces modified by friction and resistance), when the student has probably learned about forces only in air. The student is asked only to tell what makes the boat move. That constraint makes the task manageable at the middle school level.

Science evident in this student work

It is not clear whether the student did any experiments with water to construct the explanation, but the student's work does provide evidence for the following parts of:

Standard 1, Physical Sciences Concepts—motions and forces;

Standard 4, Scientific Connections and Applications—cause and effect.

Careful use of words and clear diagrams for the purposes of communicating with younger students provide evidence for the following parts of:

Standard 7, Scientific Communication—represents data and results in multiple ways; explains a scientific concept or procedure to other students; communicates in a form suited to the purpose and audience.

Physical Sciences Concepts

The relationship between force and motion is easier to illustrate in a familiar environment. To explain the forces in a liquid medium requires the student to apply the concept in an unfamiliar setting. If successful, the student's work provides evidence of conceptual understanding. This sample provides an accurate explanation of motions and forces when it shows that a force in one direction (propulsion of water backward) always results in a force in the opposite direction (pushing the boat forward). However, it is an error to attribute the push to water bouncing back. The actual force is not a bounce but simply a force resulting from the movement of water in reverse (thus moving the boat forward). The germ of an understanding of the correct mechanism for the push by the water on the propeller is there in the "resistance" of the water being pushed away. Later there is a correct explanation, when the student states that the faster the movement of water (linked to the fan analogy), the faster the forward movement of the boat.

It is important to note that the task was about the forces making the boat move and not about the energy necessary to turn the propeller. The explanation that a motor is like "a big battery" is incorrect. Boats do use chemical energy (fuel) to release heat, and it is this heat energy and not electrical energy that powers the boat. However, since the task did not ask for an analysis of energy transformations, this misconception did not take away from completing the task as it was posed.

Scientific Connections and Applications

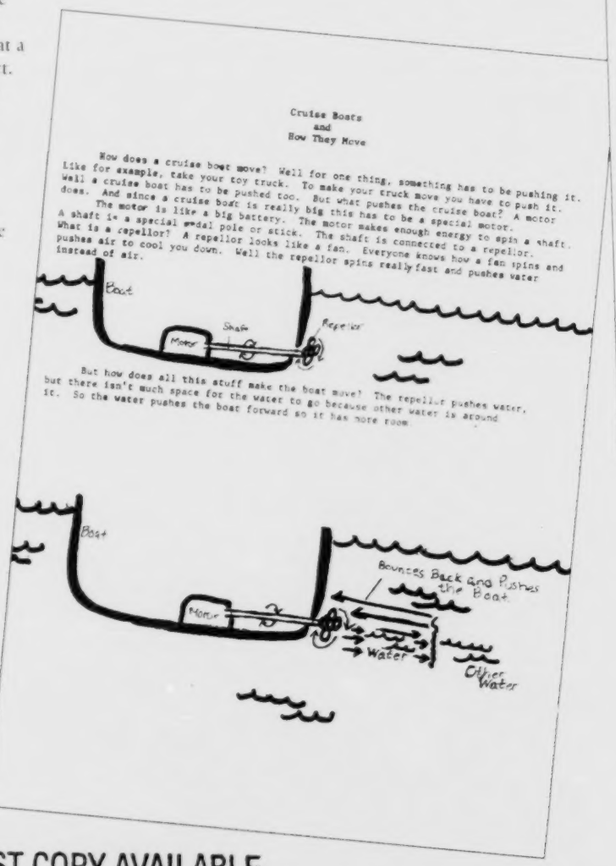
The use of the fan to explain how ships might move faster is evidence for understanding the link between the shape of the fan and the behavior of a similar design in a different setting (water). The idea of cause and effect is illustrated in the explanation that, as the fans move faster, more water is pushed, causing greater forward motion.

Scientific Communication

The task asked for an explanation to a specific audience (five- to ten-year-olds). Concepts are represented in multiple ways; the use of drawings is an effective way to illustrate the forces operating in this system. There is an appropriate level of detail necessary for a complete explanation to a younger student.

Going beyond

The work illustrates the quality of work expected for Physical Sciences Concepts. To meet the standard, however, it would need to be accompanied by work of comparable quality with properties of matter and with different forms of energy. Similarly, additional evidence of comparable quality of other aspects of Scientific Connections and Applications, Scientific Thinking, and Scientific Tools and Technologies would be required to meet these standards.

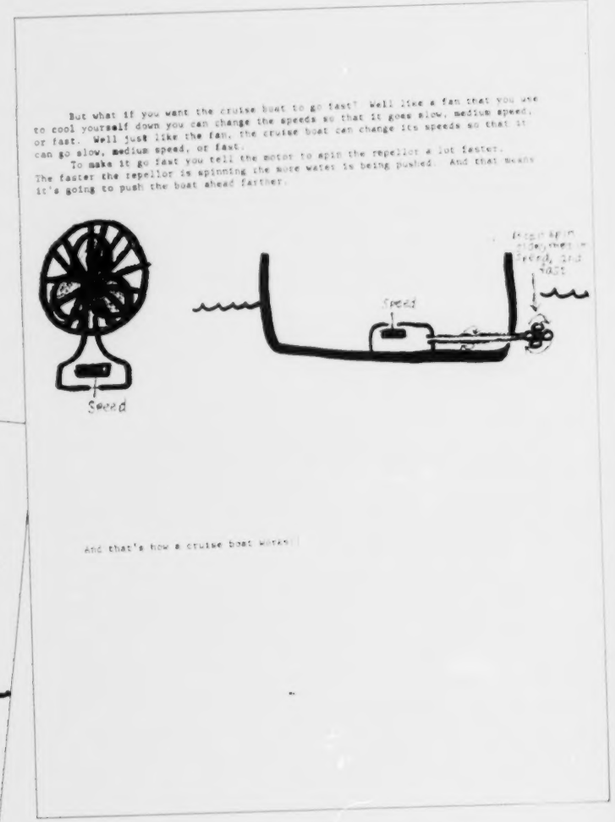


Cruise Boats
and
How They Move

How does a cruise boat move? Well for one thing, something has to be pushing it. Like for example, take your toy truck. To make your truck move you have to push it. Well a cruise boat has to be pushed too. But what pushes the cruise boat? A motor does. And since a cruise boat is really big this has to be a special motor.

The motor is like a big battery. The motor makes enough energy to spin a shaft. A shaft is a special pedal pole or stick. The shaft is connected to a repellor. What is a repellor? A repellor looks like a fan. Everyone knows how a fan spins and pushes air to cool you down. Well the repellor spins really fast and pushes water instead of air.

But how does all this stuff make the boat move? The repellor pushes water, but there isn't much space for the water to go because other water is around it. So the water pushes the boat forward so it has more room.



But what if you want the cruise boat to go fast? Well like a fan that you use to cool yourself down you can change the speeds so that it goes slow, medium speed, or fast. Well just like the fan, the cruise boat can change its speeds so that it can go slow, medium speed, or fast.

To make it go fast you tell the motor to spin the repellor a lot faster. The faster the repellor is spinning the more water is being pushed. And that means it's going to push the boat ahead farther.

And that's how a cruise boat moves!

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Work Sample & Commentary: *Seeds*

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Mathematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	**Life Sciences Concepts**	Earth & Space Sciences Concepts	Scientific Connections & Applications	**Scientific Thinking**	Scientific Tools & Technologies	Scientific Communication	**Scientific Investigation**

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

Science required by the task

Students in a community summer program were encouraged to become involved with a garden project. As part of the project they were given some casual instruction on plants and seeds. To help them identify weeds the students walked through a vacant lot near the garden wearing socks over their shoes. They collected the seeds from their socks and analyzed the seeds. They were allowed to decide how they would sort the seeds. A classification based on a variable related to a functional characteristic of the seeds asks for an understanding of the following part of:

Standard 2, Life Sciences Concepts—structure and function.

Science evident in this student work

The student classifies the seeds into monocots (monocotyledons) and dicots (dicotyledons), demonstrating classification based on an understanding of the characteristics of different groups of flowering plants. He goes further in his understanding of Life Sciences Concepts, with his analysis of possible reasons for the distribution of the data. The fieldwork on which the project is based, together with the explanations the student gives for his findings and his further work provide evidence related to parts of:

Standard 5, Scientific Thinking;

Standard 8, Scientific Investigation—fieldwork.

Life Sciences Concepts

This work provides evidence for the quality of work expected for two additional components of:

Standard 2, Life Sciences Concepts—population and ecosystems, including food webs, resources, and energy; and evolution, in particular, adaptation.

When the student predicts that seeds that were not easily classified were most likely monocots because monocots were dominant in this plot, he provides evidence for understanding populations.

When the student discusses the high proportion of monocots, he provides evidence for understanding adaptation. For example, "The dirt here was pretty dry. Or maybe the monocots are stronger and will push out the dicots from their space...When I pull up the grass there is lots of roots that spread out and maybe dicots just go straight down in the root."

Scientific Thinking

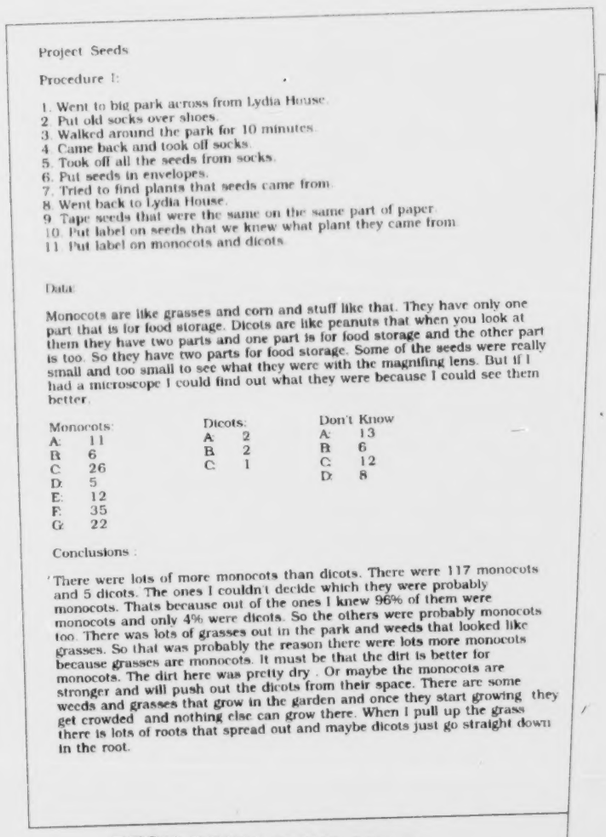
The work in the second activity provides evidence related to several components of Scientific Thinking:

- **identifies variables that influence a situation and can be controlled;**
- **uses concepts from Standards 1 to 4 to explain a variety of observations and phenomena;**
- **use evidence to develop descriptions, explanations, and models;**
- **proposes, recognizes, analyzes, considers, and critiques alternative explanations; distinguishes between fact and opinion.**

In the second activity, the work offers two examples of good scientific thinking at the middle school level: the measurement of the oil spots by comparison and the critical comment about the possibility that water caused part of a stain because there was not enough drying time. The student did not control for the size of the seeds, so the conclusions about relative amounts of oil may not be valid, nor did he indicate whether all were fresh or some were dried. These are important variables that one would expect to be identified and controlled by a student at the high school level.

Scientific Investigation

This work also provides evidence related to several aspects of Scientific Investigation. There were two studies of seeds. The identification study includes collecting and reporting data and drawing conclusions from them. The oil stain exploration has a similarly clear report of the procedures and a summary that is based on the data. Because the work does not offer a clear story line, it does not provide evidence for the quality of work expected for Scientific Investigation. In other words, the student fails to establish what question was under investigation or how the second study follows from the first.



Project Seeds

Procedure I:

1. Went to big park across from Lydia House.
2. Put old socks over shoes.
3. Walked around the park for 10 minutes.
4. Came back and took off socks.
5. Took off all the seeds from socks.
6. Put seeds in envelopes.
7. Tried to find plants that seeds came from.
8. Went back to Lydia House.
9. Tape seeds that were the same on the same part of paper.
10. Put label on seeds that we knew what plant they came from.
11. Put label on monocots and dicots.

Data:

Monocots are like grasses and corn and stuff like that. They have only one part that is for food storage. Dicots are like peanuts that when you look at them they have two parts and one part is for food storage and the other part is too. So they have two parts for food storage. Some of the seeds were really small and too small to see what they were with the magnifing lens. But if I had a microscope I could find out what they were because I could see them better.

Monocots:		Dicots:		Don't Know	
A:	11	A:	2	A:	13
B:	6	B:	2	B:	6
C:	26	C:	1	C:	12
D:	5			D:	8
E:	12				
F:	35				
G:	22				

Conclusions :

'There were lots of more monocots than dicots. There were 117 monocots and 5 dicots. The ones I couldn't decide which they were probably monocots. Thats because out of the ones I knew 96% of them were monocots and only 4% were dicots. So the others were probably monocots too. There was lots of grasses out in the park and weeds that looked like grasses. So that was probably the reason there were lots more monocots because grasses are monocots. It must be that the dirt is better for monocots. The dirt here was pretty dry . Or maybe the monocots are stronger and will push out the dicots from their space. There are some weeds and grasses that grow in the garden and once they start growing they get crowded and nothing else can grow there. When I pull up the grass there is lots of roots that spread out and maybe dicots just go straight down in the root.

Procedure II:

1. Get 5 kinds of dicots (walnuts, peanuts, limabean, pinto bean and soybean)
2. Get a hammer and some brown paper towels
3. Put one seed at a time in a paper towel in the middle
4. Hit the seed with the hammer real light because if you hit it hard you will tear the paper towel
5. Put the paper towels out where you can see them and let them sit for 10 minutes
6. Get a can of pop while you wait because you have time
7. Hold the paper towels up to the light and look at the oil spot.
8. Compare the oil spots and see which is largest.
9. Measure the oil spots at the widest part top to bottom and side to side.
10. The largest oil spot is the one with the most oil

Data:

It was hard to measure the way I thought because the oil spots were not round or square. So I held up two and picked the largest and then held it up to another one and then I found the largest and the next largest. The oil showed up best when I put it up in a window. The peanut had the biggest oil then the walnut then the soybean then the pinto bean and lima bean were the same.

Conclusions.

I should have let the paper towels dry more because I think some of the lima bean and the soybean may be water. But the peanut and the walnut had a lot of oil. I was surprised by how the soybean was. I didn't think it would have any oil but it did. The oil is like fat and so it would be best if you ate the lima bean and the pinto beans. I would like to find other dicots and try them.

Going beyond

Each of the standards mentioned is only partially demonstrated in this piece of work. Additional evidence of similar quality demonstrating understanding of reproduction and behavior would be required to meet the Life Sciences Concepts standard; additional evidence of similar quality in analysis and critique would be required for the Scientific Thinking standard; and a more coherent presentation would be required for the Scientific Investigation standard.

The quotations from the Science performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 48-49.

Best practice in Science has always included extensive inquiry and investigation, but it is frequently given less emphasis at the middle school level where teachers are challenged to provide the resources and supervision to upwards of 180 students. There are many opportunities to conduct investigations outside of school, including Scouts, Boys and Girls Clubs, 4-H and Future Farmers of America. The work done in these venues can and should be used to provide evidence of meeting the standards.

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Work Sample & Commentary: *Passive Solar Homes*

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving Mathematical & Reasoning	Mathematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	**Earth & Space Sciences Concepts**	**Scientific Connections & Applications**	Scientific Thinking	Scientific Tools & Technologies	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

The quotations from the Science performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 48-49.

Science required by the task

The task asked students to design and build a model which would illustrate a form of renewable energy and to make a presentation. In order to come up with an accurate design, background research had to be completed. The task's focus on renewable energy sources and the requirement that students design and build a model meant they had to produce work related to the following parts of the Science standards:

Standard 3, Earth and Space Sciences—natural resource management.

Standard 4, Scientific Connections and Applications—big ideas and unifying concepts; technology.

Science evident in this student work

This student chose the topic of passive solar homes. Included here are the written report, a design drawing, and notes for the presentation. The model was built but is not included here. This collection of evidence demonstrates some of the conceptual understanding defined by Standards 3 and 4.

Earth and Space Sciences Concepts

The discussion of heat and light energy, renewable resources, and the benefits of solar energy in this work provides evidence for the quality of work expected for understanding the concept of natural resource management. An explanation of solar heating and how it captures energy provides the framework from which a knowledgeable design is made and model constructed, i.e., "The energy passes through the windows and heats the air".

Scientific Connections and Applications

This work also provides evidence big ideas and unifying concepts, specifically form and function; and technology, including tradeoffs, constraints, feedback, and risk.

The student's explanation of the purpose for each of the components of a passive solar home is evidence for understanding the concept of form and function, particularly the second paragraph of the written report, from "It is equipped with a black asphalt roof to collect, store and distribute heat..." to "To prevent overheating the house is equipped with ventilation, overhangs, shades and landscaping."

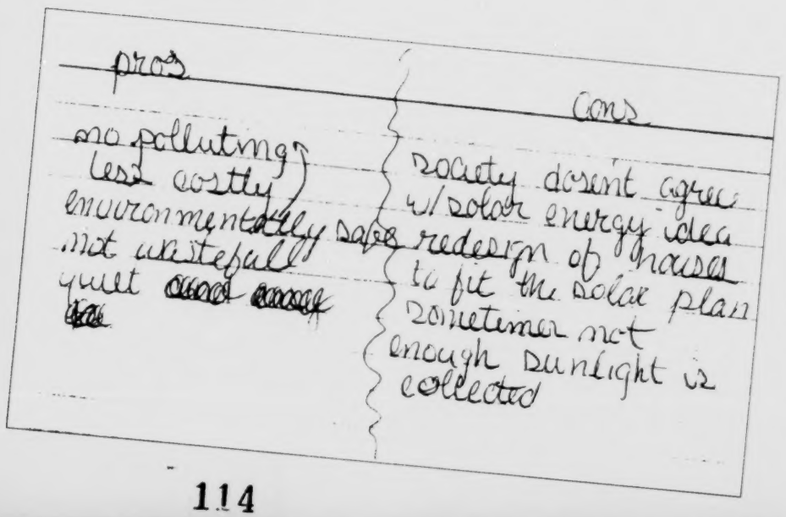
The analysis of tradeoffs, part of an understanding of technology, is evident in the presentation notes under the titles "pros" and "cons." Attention to tradeoffs is also present in the written report. Both the positive impacts (such as "solar homes do not pollute, and are less costly for government and homeowners") and the negative impacts (such as "redesigning of houses and subdivisions would have to take place to fit the needs of solar energy") are noted, and a conclusion is drawn: that solar energy is a cost efficient and productive resource.

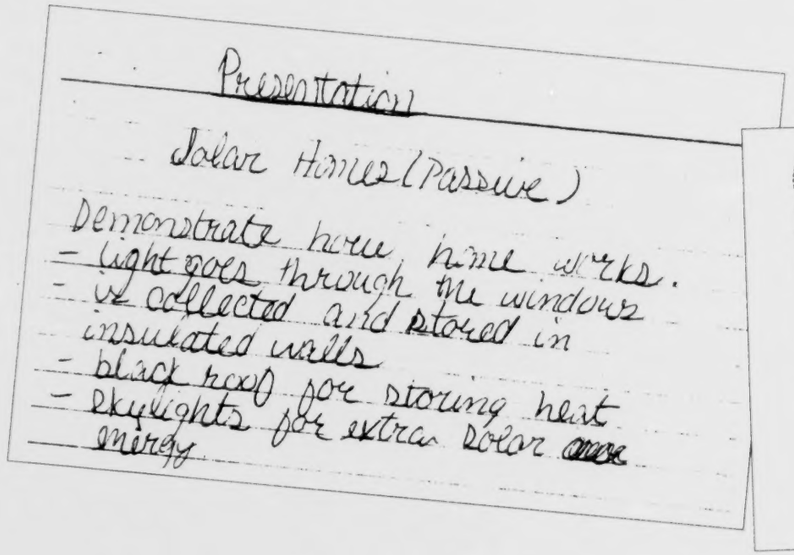
Recognition of the transformation of light energy to heat energy is apparent in the statement, "The sunlight is stored as heat and later released." The underlined forms of energy are emphasized in the student's work. This emphasis provides evidence for understanding parts of Standard 1, Physical Sciences Concepts—transfer and transformation of energy, including forms and conversions, illustrating that Scientific Connections and Applications involves applications of concepts presented by other standards.

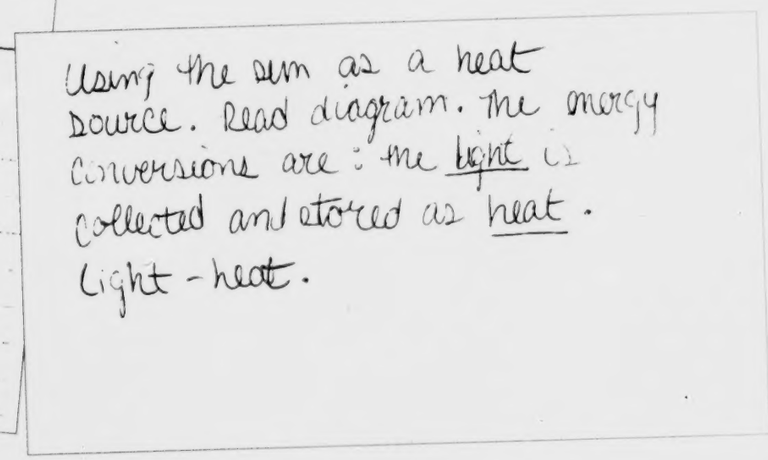
Going beyond

This work would be strengthened by addressing additional issues often seen as drawbacks to solar energy; for example, how to harness the energy so that it is available at night or at times when the sky is cloudy, as well as the need for an appropriate climate. Similarly, the work does not address the issue of moving the heat from the roof to the inside of the house or throughout the home with ventilation fans. The work is of sufficient quality for the middle school level. The understanding necessary to make different climates part of design decisions would be more appropriate to the high school level. It would be powerful for this portfolio entry to be revised by the same student two years later, after more experience with science.

The work represents the quality expected for some aspects of Earth and Space Sciences and Scientific Connections and Applications at the middle school level. To say that these standards have been met, however, it would need to be complemented by work of comparable quality demonstrating other aspects of these standards: Earth's systems and history for the former; and other big ideas and health for the latter.




Presentation
Solar Homes (Passive)
Demonstrate how home works.
- light goes through the windows
- is collected and stored in insulated walls
- black roof for storing heat
- skylights for extra solar energy


Using the sun as a heat source. Read diagram. The energy conversions are: the light is collected and stored as heat.
Light - heat.

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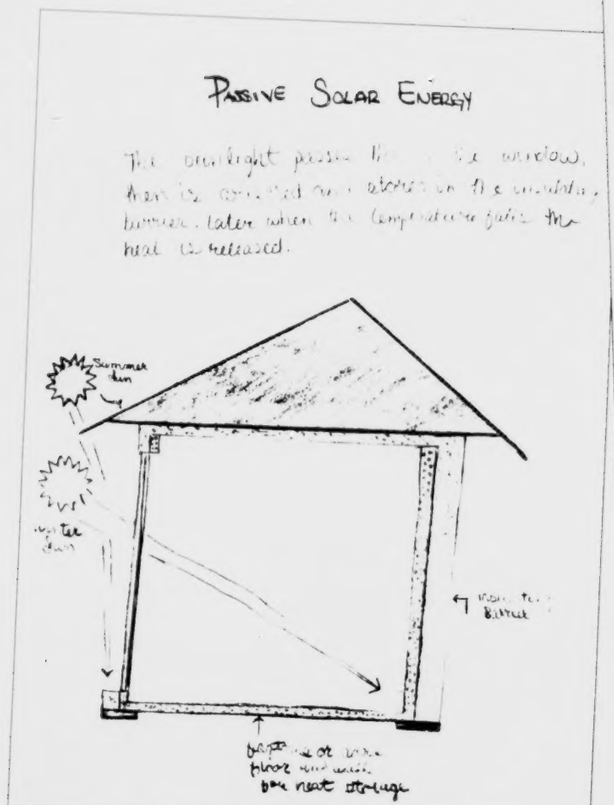

PASSIVE SOLAR ENERGY

The sunlight passes through the window. Heat is absorbed and stored in the insulating barrier. Later when the temperature falls the heat is released.

Passive Solar Homes

Solar energy can be used in many ways. It can be used to heat water, cook food, and even heat and provide energy for homes. It is a very reliable source.

Passive solar homes run on passive solar energy. The home is equipped with special devices to run on solar energy. It is equipped with a black asphalt roof to collect, store, and distribute the heat. It also has full length windows on the south side for the sunlight to pass through and collect in the insulation inside the walls. There are also windows on a slanted roof for extra sunlight. The house has flagstone or adobe floors and walls for heat storage. To prevent overheating the house is equipped with ventilation, overhangs, shades, and landscaping.

The energy passes through the windows and heats the air. Then the walls and floors absorb and store excess heat. The stored heat is later released when the temperature falls. When the energy passes through the windows and is collected in the walls, then later released the energy conversion from this is light to heat. The sunlight is stored as heat and later released.

Solar energy is a renewable source. It comes only from the sun. The sun can't run out of energy until it stops burning. The sun is always burning, therefore, solar energy is renewable. Solar energy will always be renewable until the sun stops burning.

The cost efficiency for having a solar home is very inexpensive. The only thing needed for a solar home is large windows, insulation in the walls and floors, and adobe or flagstone. Solar energy does not need extra energy to run it, therefore, there are no extra costs. Solar energy is not wasteful and is a low-cost system.

A passive solar home provides day lighting and improves comfort with radiant heat. Solar energy is a renewable heating system that is quiet and reliable, has low maintenance, no moving parts, and lasts longer than other heating systems. The solar home also has a minimum impact on the environment. It uses no gas, coal, petroleum, or any other polluting energy sources. It uses only the sun which does not pollute the environment or harm it in any way.

Solar energy has very little impact on society. Positive impacts on society are that solar homes do not pollute, and are less costly for the government and homeowners. Negative impacts are that parts of society do not agree with the solar energy idea. Also, redesigning of houses and subdivisions would have to take place to fit the needs of solar energy.

Solar energy is a very easy and productive resource. It is environmentally safe and does not cost much at all. Solar energy is the ideal renewable energy source.

In Japan, middle school teachers should "make students consider the relationships between matters and phenomena in the natural world as well as the harmony among them, and realize the influence of the natural world on the existence of human beings, thereby heightening students' interest in preservation of the natural environment."

Course of Study for Lower Secondary Schools in Japan, p. 52.

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Work Sample & Commentary: *Paper Towels*

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Math ematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	**Scientific Connections & Applications**	**Scientific Thinking**	Scientific Tools & Technologies	**Scientific Communication**	**Scientific Investigation**

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

The quotations from the Science performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 48-49.

Science required by the task

Students in a middle school physical science class were asked to perform consumer product tests on one of several different common products. They were asked to perform detailed and accurate testing and to report results in a form for public presentation. Further, the students were asked to design and give a presentation promoting the most successful product. The work done in response to this part of the task (a video) is not included here. Students had two weeks to complete the task, which was part of a unit on scientific methodologies.

The task asked for work related to parts of the following Science standards:

Standard 4, Scientific Connections and Applications;
Standard 5, Scientific Thinking;
Standard 7, Scientific Communication;
Standard 8, Scientific Investigation.

Science evident in this student work

The student selected paper towels as the product to test. The attributes of strength and durability were selected. The teacher gave some direction in setting up the strength test and the student designed the durability test. The student completed the bulk of the project alone but was allowed to seek help throughout the task. Revision was possible during this time.

The work provides evidence for the quality of work expected for parts of Scientific Connections and Applications, Scientific Thinking, and Scientific Investigation. Errors in communication would have to be revised to provide adequate evidence for Scientific Communication.

Scientific Connections and Applications

The description of how paper towels are put together and the definition of paper towel strength show understanding of "the designed world". The work defines the main uses for these products and sets up a test to simulate those uses. The work also provides evidence for accurate work with the concepts of "form and function" (a thicker paper towel will be stronger) as well as "cause and effect."

Scientific Thinking

The project required an approach to a rather simple task as well as the design of a fair test of two qualities one would desire in a paper towel. The variables of surface area and amount of water are identified. A test is set up in which all products were subjected to the same treatment. The use of the same bowl, amount of water, and the pennies as mass pieces provides evidence for an important part of Scientific Thinking: identifies variables that influence a situation and can be controlled.

Scientific Communication

The task required the student to report results in a manner that would be presentable to the public. Typically, a middle school student explores many different ways to report quantitative results. Here, however, we see the selection of an inappropriate graph (pie chart) to communicate data that should have been reported in another graphic form. The graph is constructed in a mathematically correct fashion. The next graph, the bar graph, is an appropriate way to represent the data. The text that refers to the second data table and graph do not agree; specifically, in the table, the values of Job Squad and Bounty are exchanged.

Scientific Investigation

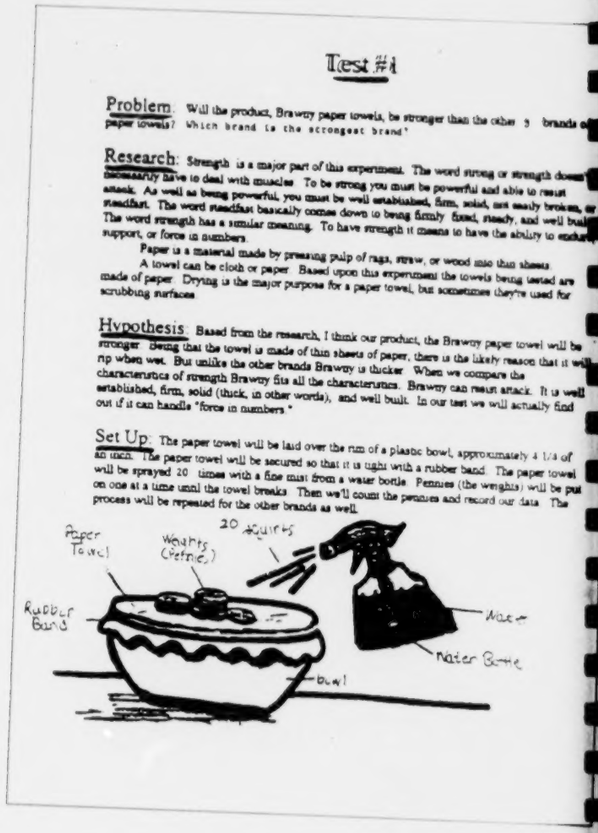
In addition to providing evidence for the parts of Scientific Investigation discussed above, the work provides evidence for having done a full investigation, in its clear description of the procedures used, such that another student could replicate and verify the experiments. The recommendations of the "best" paper towel, at least by this definition, are based on the data.

Paper towel testing is a common middle school activity, but many students select variables that are social in their nature, e.g., cost, appearance, that are more easily measured than are strength or performance. This project tackled variables that required more imagination and effort to measure.

Going beyond

The student's investigation did not ask why one paper towel is stronger than another. In a classroom it would be simple to seed this question and allow the student to add that exploration to this work. By exploring the fiber size, the capillary action of these fibers, the way that paper towels are put together, or similar designs in nature, the student would encounter parts of Physical Sciences Concepts or Life Sciences Concepts. That would strengthen this work as a portfolio exhibit for Scientific Investigation and is expected at the high school level. Similarly, multiple trials are expected at the high school level.

Thus, this work meets the Scientific Investigation standard at this level. It provides evidence for Scientific Connections and Applications that would need to be supplemented with work of comparable quality on other big ideas and health. It provides evidence of Scientific Thinking that would need to be complemented with work of comparable quality that includes critiquing the work of others.



Test #1

Problem: Will the product, Brawny paper towels, be stronger than the other 3 brands of paper towels? Which brand is the strongest brand?

Research: Strength is a major part of this experiment. The word strong or strength doesn't necessarily have to deal with muscles. To be strong you must be powerful and able to resist attack. As well as being powerful, you must be well established, firm, solid, not easily broken, or steadfast. The word steadfast basically comes down to being firmly fixed, steady, and well built. The word strength has a similar meaning. To have strength it means to have the ability to endure support, or force in numbers.

Paper is a material made by pressing pulp of rags, straw, or wood into thin sheets. A towel can be cloth or paper. Based upon this experiment the towels being tested are made of paper. Drying is the major purpose for a paper towel, but sometimes they're used for scrubbing surfaces.

Hypothesis: Based from the research, I think our product, the Brawny paper towel will be stronger. Being that the towel is made of thin sheets of paper, there is the likely reason that it will rip when wet. But unlike the other brands Brawny is thicker. When we compare the characteristics of strength Brawny fits all the characteristics. Brawny can resist attack. It is well established, firm, solid (thick, in other words), and well built. In our test we will actually find out if it can handle "force in numbers."

Set Up: The paper towel will be laid over the rim of a plastic bowl, approximately 4 1/4 of an inch. The paper towel will be secured so that it is tight with a rubber band. The paper towel will be sprayed 20 times with a fine mist from a water bottle. Pennies (the weights) will be put on one at a time until the towel breaks. Then we'll count the pennies and record our data. The process will be repeated for the other brands as well.

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Students in Australia can meet the standard for Materials and Their Uses by identifying "factors that determine the choice of materials for particular purposes." This is "evident when students, for example, argue for using a material for a certain purpose by evaluating a variety of technical, economic and environmental factors."

Science—a curriculum for Australian schools, p. 61.

Test #2

Problem: Will the product, Brawny paper towels be stronger than the other 3 brands of paper towels? Which brand is the strongest brand?

Research: Strength is a major part of this experiment. The word strong or strength doesn't necessarily have to deal with muscles. To be strong you must be powerful and able to resist attack. As well as being powerful, you must well established, firm, solid, not easily broken, or steadfast. The word steadfast basically comes down to being firmly fixed, steady, and well built. The word strength has a similar meaning. To have strength it means to have the ability to endure, support, or force in numbers.

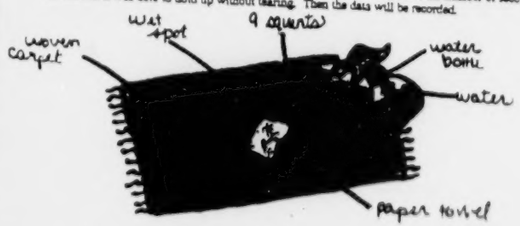
Paper is a material made by pressing pulp of rags, straw, or wood into thin sheets.

A towel can be cloth or paper. Based upon this experiment the towels being tested are made of paper. Drying is the major purpose for a paper towel, but sometimes they're used for scrubbing surfaces.

Carpet is a woven or felted piece of material that covers floors. In many cases carpet must be cleaned. Usually they are cleaned with vacuums but sometimes when there is a spill a cleaning solution and a bundle of paper towels will do the job.

Hypothesis: Based from the research, I think our product, the Brawny paper towel will be stronger. Being that the towel is made of thin sheets of paper, there is the likely reason that it will rip if wet. But unlike the other brands Brawny is thicker. When we compare the characteristics of strength Brawny fits all of them. Brawny can resist attack. It is well establish, firm, solid, (thick in other words), and well built. In our second test we will actually find out if it can handle scrubbing a spill on a rough, woven piece of carpet.

Set Up: In this experiment the first step is to wet one area of the carpet by squirting it 9 times with the water bottle. The area will be squirted 9 times in the exact area for a single test. Then when the second brand is tested we'll move to a different area and squirt nine times (and so on). The wet surface will be scrubbed with one sheet of the paper towel. The carpet will be scrubbed over and over with the paper towel until the paper towel begins wearing away. With the first notice of "wear and tear" we'll stop rubbing. Each brand will be timed for the number of second or minutes it was able to hold up without tearing. Then the data will be recorded.



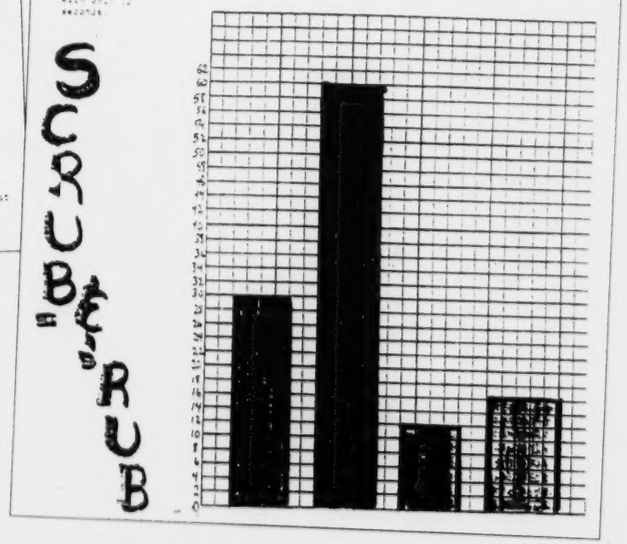
Test #1 Graph

Brand of Paper Towel	# of Pennies it held
Bounty	196
High Dry	31
Job Squad	264
Brawny	256

Test #2

Brand of Towel	Amount of Time before Wear & Tear
Brawny	30 seconds
Bounty	60 seconds (1 minute)
High Dry	12 seconds
Job Squad	16 seconds

Scrub & Rub



Conclusion:

Based from both tests and graphs, I compared my results and found that my hypothesis was incorrect. Job Squad turned out to be the stronger brand in both tests. Job Squad was able to hold 264 pennies before breaking, and was able to last 60 seconds without wear or tear. In the hypothesis I predicted that Brawny would be the strongest, but found that it was 8 pennies short of being tied with Job Squad. In the Scrub and Rub test theur was a great difference in the results Job Squad lasted for 60 seconds, while Brawny was only able to last for 30 seconds-a difference of 30 seconds.

When making my hypothesis I had trouble decided on which brand would be the strongest. Two of the four paper towels were rather thick, but Bounty seemed to be a bigger sheet. In my hypothesis I was partly right, Bounty was strong-but not the strongest.

Job Squad is the better and stronger brand. It can handle force in numbers, and obviously it was built very well, firm, steady, and it was not easily broken.

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Work Sample & Commentary: *Emergency Response*

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Mathematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	**Scientific Connections & Applications**	Scientific Thinking	Scientific Tools & Technologies	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

The quotations from the Science performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 48-49.

The standards for elementary school are set at a level of performance approximately equivalent to the end of fourth grade and for middle school at the end of eighth grade. It is expected that some students might achieve these levels earlier and others later than these grades. It is the expected quality of work rather than the age or grade of the student that we are attempting to illustrate. We have used five samples of student work done when the students were in the sixth grade. Three were included in the elementary volume; this sample and the one that follows illustrate the middle school standard.

Safety is an interdisciplinary standard in French middle schools. The curriculum calls for the student to "identify risks and prepare to protect and respect himself and others from major natural disasters: cyclones, tidal waves, volcanic eruptions, earthquakes, avalanches, floods, fires, and mud slides, taking account of regional features."

Collèges: Programmes et Instructions, p. 333.

Science required by the task

In an on-demand task, students in a sixth grade self-contained classroom were asked what they would do to protect themselves during two emergency situations: if they were outside during a lightning storm and if they were indoors during a strong earthquake. The task required students to demonstrate understanding related to the following part of:

Standard 4, Scientific Connections and Applications—safety.

Science evident in this student work

The responses give correct procedures for dealing with natural emergencies. The student goes beyond the requirements of the task, by giving scientific explanations for the procedures, including parts of:

Standard 1, Physical Sciences Concepts—motions and forces (the concept of pressure); transfer and transformations of energy (the concept of conductivity).

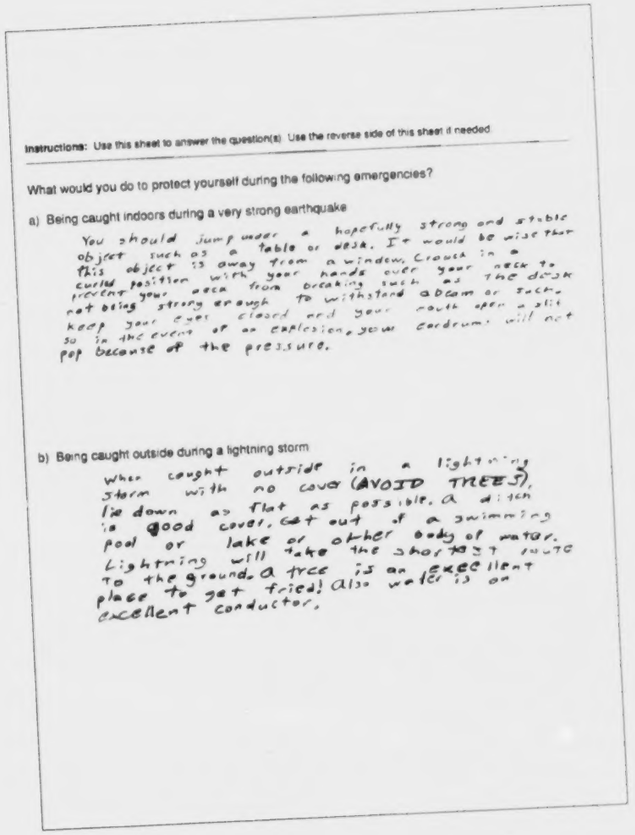
Scientific Connections and Applications

These responses illustrate the application of science concepts to an understanding of safety. In each response, several steps are recommended and some are explained. With respect to the earthquake, three steps are recommended: seeking cover, especially protecting your neck; avoiding flying glass, especially in your eyes; and opening your mouth to protect your eardrums. While the likelihood of sufficient pressure from an explosion to harm the eardrums is low, the technique is simple enough to follow, and it is properly explained.

The response to the lightning storm prompt is similarly complete. Lying down flat and avoiding trees and water are the appropriate procedures. The explanation, that the lightning will seek the shortest route and thus conductors should be avoided, is also correct.

Going beyond

The work shows a good understanding of an important health concept (safety), and it makes sufficient connections to the underlying science concepts to provide evidence for the quality of work expected for this part of Scientific Connections and Applications. Including consideration of other parts of health and technology included in the standard would provide more complete evidence for understanding Scientific Connections and Applications. The evidence for understanding parts of the standard for Physical Sciences Concepts, while correct, is insufficient in and of itself to meet the standard.



Instructions: Use this sheet to answer the question(s). Use the reverse side of this sheet if needed.

What would you do to protect yourself during the following emergencies?

a) Being caught indoors during a very strong earthquake

You should jump under a hopefully strong and stable object such as a table or desk. It would be wise that this object is away from a window. Crouch in a curled position with your hands over your neck to prevent your neck from breaking such as the desk not being strong enough to withstand a beam or such. keep your eyes closed and your mouth open a slit so in the event of an explosion, your eardrums will not pop because of the pressure.

b) Being caught outside during a lightning storm

When caught outside in a lightning storm with no cover (AVOID TREES), lie down as flat as possible. A ditch is good cover, get out of a swimming pool or lake or other body of water. Lightning will take the shortest route to the ground. A tree is an excellent place to get fried! Also water is an excellent conductor.

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Work Sample & Commentary: *Spot Remover*

1 Reading	2 Writing	3 Speaking, Listening & Viewing	4 Conventions, Grammar & Usage	5 Literature

English Language Arts

1 Number& Operation Concepts	2 Geometry & Measurement Concepts	3 Function & Algebra Concepts	4 Statistics & Probability Concepts	5 Problem Solving & Mathematical Reasoning	6 Mathematical Skills & Tools	7 Mathematical Communication	8 Putting Mathematics to Work

Mathematics

1 Physical Sciences Concepts	2 Life Sciences Concepts	3 Earth & Space Sciences Concepts	4 Scientific Connections & Applications	5 Scientific Thinking	6 Scientific Tools & Technologies	7 Scientific Communication	8 Scientific Investigation

Science

1 Problem Solving	2 Communication Tools & Techniques	3 Information Tech. Tools & Techniques	4 Learning & Self-mgmt. Tools & Techniques	5 Tools & Techniques for Working With Others

Applied Learning

Science required by the task

In an on-demand task, students in a sixth grade self-contained classroom were asked to describe in detail an experiment that a person might perform to find out which of two spot removers is better for removing stains from fabrics. The task was unrelated to the curriculum. There was no opportunity for assistance or revision. The task required students to provide evidence related to parts of the following Science standards:

Standard 5, Scientific Thinking;
Standard 7, Scientific Communication.

Science evident in this student work

Two responses are shown. Both responses give correct procedures for conducting the experiment, identifying variables to be controlled and communicating a procedure, as required by the task.

Scientific Thinking

Both responses provide evidence for identifying variables that influence a situation and can be controlled. In the first work sample, three variables are explicitly identified and controlled: "the same material," "the same amount" (of staining liquid), and "the same amount of time" (for the stain remover to work). A fourth variable (the same staining liquid) is implied by the word "it" in the second sentence. In the second work sample, four variables are explicitly identified and controlled: "the same material," "the same amount of time" (for the stain to set), "washed in the same way," and "for the same amount of time." A fifth variable (the same staining liquid) is implied by "put a stain on each." Both work samples are correct in the variables they identify. Because the task says, "Describe in detail...," one could argue that the second piece of work is slightly better than the first, but unless the students are cued to think of as many variables as possible, which is different from "detail," both work samples are equally valid as evidence for "Identifying variables that influence a situation and can be controlled."

The second response offers evidence for a part of Scientific Thinking that is not offered in the first, where the student offers explanations for the procedures used: "The fabric should be old...because..."; "The fabric should be made of the same material just in case..."; and the time should be the same "to make sure one doesn't stain worse because...." Again, this response was not required by the task, but by including it the second response provides stronger evidence for this standard.

These responses illustrate one of the challenges of evaluating open-ended tasks, where more verbal students may, by simply writing more, provide more evidence of understanding.

Scientific Communication

Both responses provide evidence for explaining a scientific concept or procedure to other students. For the reasons stated above, the second response is stronger than the first.

Going beyond

To meet the standard for Scientific Thinking, this work would need to be accompanied by work of comparable quality that provides evidence for carrying out a procedure and evaluating the results, particularly if the results are not as clear as expected. To qualify as meeting the expectations for Scientific Investigation, the work would need to include evidence for multiple trials and trials on more than one staining liquid. Similarly, to meet the standard for Scientific Communication, this work would need to be accompanied by work of comparable quality that provides evidence for communicating in a variety of forms and for a variety of purposes.

Sample 1

Instructions: Use this sheet to answer the question(s). Use the reverse side of this sheet if needed.

A person wants to determine which of two spot removers is more effective. Describe in detail an experiment the person might perform in order to find out which spot remover is better for removing stains from fabrics.

Get some liquid that leaves spots, like spaghetti sauce or vegetable soup. Spot two shirts of the same material with it. Put the same amount on both shirts. Then soak one shirt in on spot remover and the other shirt in the other spot remover. Leave the shirts in the liquid for the same amount of time. (Leave the shirts in the spot remover for about 1 day.) Then take the shirts out, whichever spot remover got rid of the spots best is the best spot remover.

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Sample 2

Instructions: Use this sheet to answer the question(s). Use the reverse side of this sheet if needed.

A person wants to determine which of two spot removers is more effective. Describe in detail an experiment the person might perform in order to find out which spot remover is better for removing stains from fabrics. That person should find two old pieces of fabric made from the same material. The fabric used should be old only because if the stain isn't removed, they won't be as disappointed. The fabric should be made from the same material just in case one kind of material stains worse. Next put a stain on each piece of fabric (grape juice, spaghetti sauce). Let them sit for the same amount of time to make sure one doesn't stain worse because it sat longer. Then wash one with one spot remover and the other with the other spot remover. After they are washed the same way for the same amount of time, compare the stains. The person should buy the spot remover that removed the stain the best.

This works well plus it is a fun experiment to do!

The quotations from the Science performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 48-49.

Students in New Zealand can show what they know about the standard for Making Sense of the Nature of Science and its Relationship to Technology by showing their "ability to recognize whether or not a conclusion is soundly based, when the students reflect on three conclusions provided in a report of a 'fair test' to determine the best stain remover."

Science in the New Zealand Curriculum, p. 33.

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Work Sample & Commentary: *Moon Study*

1 Reading	2 Writing	3 Speaking, Listening & Viewing	4 Conventions, Grammar & Usage	5 Literature

English Language Arts

1 Number & Operation Concepts	2 Geometry & Measurement Concepts	3 Function & Algebra Concepts	4 Statistics & Probability Concepts	5 Problem Solving & Mathematical Reasoning	6 Math ematical Skills & Tools	7 Mathematical Communication	8 Putting Mathematics to Work

Mathematics

1 Physical Sciences Concepts	2 Life Sciences Concepts	**3 Earth & Space Sciences Concepts**	4 Scientific Connections & Applications	5 Scientific Thinking	6 Scientific Tools & Technologies	7 Scientific Communication	**8 Scientific Investigation**

Science

1 Problem Solving	2 Communication Tools & Techniques	3 Information Tech. Tools & Techniques	4 Learning & Self-mgmt. Tools & Techniques	5 Tools & Techniques for Working With Others

Applied Learning

The quotations from the Science performance descriptions in this commentary are excerpted. The complete performance descriptions are shown on pages 48-49.

Science required by the task

Students who had been studying the solar system were asked to pursue an individual project relating to the solar system. The project asked students to demonstrate understanding of:

Standard 3, Earth and Space Sciences Concepts—Earth in the Solar System.

Science evident in this student work

This student chose to learn more about the phases of the Moon, a concept he had recently studied but did not understand. By reading and gathering data, he engaged in fieldwork, a type of investigation included in:

Standard 8, Scientific Investigation.

The student's work provides evidence for an emerging understanding of parts of Earth in the Solar System. It also shows the kind of work that comes from student initiated questions and from giving students opportunities to make sense of concepts that they themselves recognize they do not understand well enough.

Earth and Space Sciences Concepts

The student's analysis of the pattern shows an understanding of the relationship between the shape of the Moon visible from Earth and the position of the Moon with respect to the Earth and the Sun. Making inferences about the changing visible shape of the Moon from "full" to "crescent," the student draws conclusions, such as: "When the moon was full it was farther away from the sun than when it was crescent...Because when the moon is between the earth and the sun it would be super close to the sun and a new moon." Some knowledge of the relative position of the Sun and the Moon is implied by statements such as: "The full moon is when the moon is facing the sun so the earth is sort of between the moon and the sun." The illustration shows an understanding of the relative scale of the Sun, the Earth and the Moon, though not of their relative distances from one another.

Considering the additional phenomena of lunar and solar eclipses, the student makes an inference which is an extension of what is understood of those phenomena: "If the sun was exactly behind the earth then we would have an eclipse of the moon because of the earth shadow. On the other side when the moon is in the new phase it could be a solar eclipse because the sun is blocked by the moon."

The two cycles charted in this work are related. The work does not show a complete connection, since the drawing does not indicate the relationship between the shape of the Moon and the date of his observations. However, the student does make a connection between the Moon's position and the shape of its phase, when he says: "When the moon was full it was farther away from the sun than when it was crescent...Because when the moon is between the earth and the sun it would be super close to the sun and a new moon."

Scientific Investigation

The student used data to construct the position of the Moon. Daily observations were collected and recorded over a 30-day period. The interpretation of the data is accurate and well articulated. Explanations of the phases of the Moon in the conclusions are drawn directly from the evidence gained in the investigation.

The student provides evidence for an awareness of the importance of controlling variables in his comment regarding the data collection method: "I had to make some of my measures at different times of the day because of clouds." However, in the present case, time of day would not alter the data.

Going beyond

The use of fists is an appropriate measure at the middle school level. Any measure that can show that the cycle comprises 360 degrees and that can be regularly (if arbitrarily) divided is appropriate. Since the cycle goes from 20 fists to one and then back up to about 20, the full cycle is implied. The use of a protractor or clinometer to measure degrees would be more accurate and appropriate. These instruments could be used effectively even at the middle school level. At the high school level, more sophisticated measuring techniques are expected in investigations such as this. This piece of work could be used in a portfolio to illustrate fieldwork for Scientific Investigation. To say that the student had met the standard for Earth and Space Sciences Concepts, this work would need to be accompanied by additional work of comparable quality related to Earth's systems and history.

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Japanese students are supposed to "make conjectures about the motion of the earth through observations of celestial bodies, understand the structure of the solar system, and comprehend the universe that encompasses stars and earth."

Course of Study for Lower Secondary Schools in Japan, p. 53.

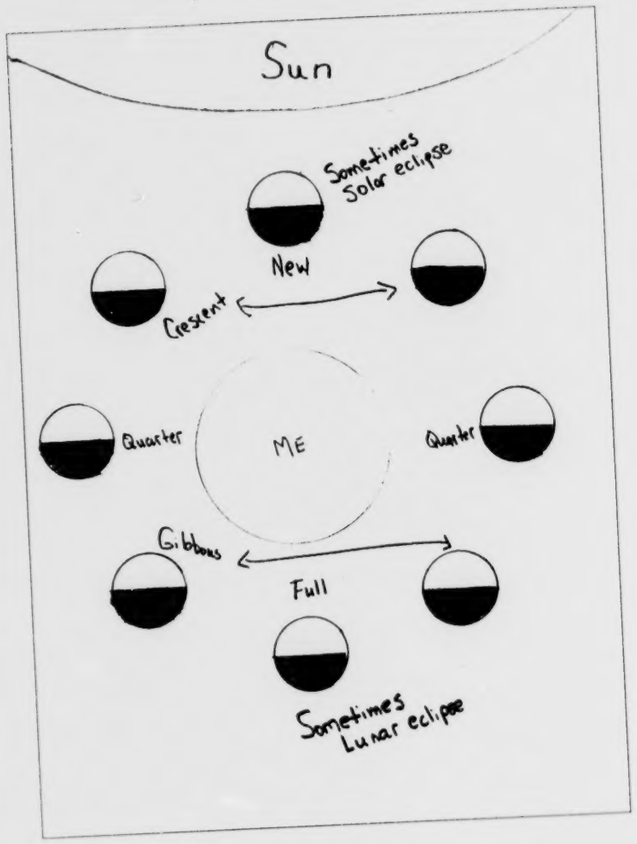
Moon Study

My teacher tried to explain why there are phases of the moon. But, I really didn't understand even after the lab with the styrofoam ball. So. I went home and found a book that gave me some ideas about how to find out. This is what I did.

Part 1. I made observations of the moon in the daytime from the full moon until the new moon (about a month). I counted the number of fists between the moon and the sun. I held my arm out as far as I could each time and I put my thumb fist side to the sun each time.

Day	Number of fists	moon
1	20	full
2	19	sort of full
3	cloudy	cloudy
4	cloudy	cloudy
5	15	gibbous
6	13	same
7	11	quarter (looks like half)
8	9	same
9	cloudy	cloudy
10	6	crescent (little sliver)
11	4	same
12	2	same
13	1	tiny crescent
14	1 (less than)	new moon (all shadow)
15	2	tiny crescent
16	3	same
17	5	crescent
18	7	same
19	9	crescent sort of
20	10	crescent
21	cloudy	
22	cloudy	
23	cloudy	
24	cloudy	
25	16	gibbous
26	18	same
27	19	almost full but not quite
28	cloudy	
29	cloudy	
30	cloudy	

When the moon was full it was farther away from the sun than when it was crescent. I had to make some of my measures at different times of the day because of clouds. I guess that makes sense. Because when the moon is between the earth and the sun it would be super close to the sun and a new moon. Then when the moon moves it doesnt matter what way goes around the earth because it would be a crescent moon next. And the crescent moon was the next farthest by my fist measures. The full moon is when the moon is facing the sun so the earth is sort of between the moon and the sun. If the sun was up over our back than it would still hit the moon and lite it up. If the sun was exactly behind the earth then we would have an eclipse of the moon because of the earth shadow. On the other side when the moon is in the new phase it could be a solar eclipse because the sun is blocked by the moon.



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Samples of student work that help explain "how good is good enough" for these standards can be found immediately following these pages.

To see how these performance descriptions compare to the expectations for elementary school and high school, turn to pages 98-102.

The standards for Applied Learning have been revised substantially since the last published draft of these Performance Standards. Contact New Standards for information about the content framework that has provided the foundation for the Applied Learning standards.

These performance descriptions contain extensive cross-referencing, both between Applied Learning and English Language Arts, Mathematics, and Science, and among the Applied Learning standards.

The cross-referencing to English Language Arts, Mathematics, and Science is intended to illustrate some of the ways in which Applied Learning may be integrated with the subject areas and may provide a vehicle for learning in the disciplines. These references are shown only for Standard 1, Problem Solving.

The cross-referencing among the Applied Learning standards is intended to illustrate some of the ways in which a single project can provide a vehicle for demonstrating achievement of a number of Applied Learning standards. It is intended that Applied Learning tools and techniques be developed in conjunction with problem solving projects, rather than as isolated skills.

1. Problem Solving

Apply problem solving strategies in purposeful ways, both in situations where the problem and the desired solutions are clearly evident and in situations where they are not.

The student completes projects involving at least two of the following kinds of problem solving each year and, over the course of middle school, projects involving all three kinds of problem solving.

- **Designing: identifying needs that could be met by new products, services, or systems; and creating solutions for meeting them;**
- **Planning and Organizing: taking responsibility for all aspects of planning and organizing an event or activity from concept to completion, making good use of the resources of people, time, money, and materials and facilities;**
- **Improving a System: developing an understanding of the way systems of people, machines, and processes work; troubleshooting problems in their operation; and devising strategies for improving their effectiveness.**

A single project may involve more than one kind of problem solving.

DESIGNING

The student designs a product, service, or system to meet an identified need; that is, the student:

- **develops a range of design options;**
- **selects one design option to pursue and justifies the choice, for example, with reference to functional, aesthetic, social, economic, or environmental considerations;**
- **identifies, where relevant, the principles on which the decision was based, such as aesthetic, mathematical, scientific;**
- **uses appropriate conventions to represent the design;**
- **establishes criteria for judging the success of the design;**
- **plans and carries out the steps of the production process;**
- **adjusts the production process as required to achieve specified standards of quality and safety;**
- **evaluates the quality of the design by considering the criteria for success and by comparison with similar products, services, or systems.**

Examples of designing include:

- designing and producing a history periodical for students *(see also Applied Learning Standards 2, 3, 4, and 5; English Language Arts Standard 2);*
- designing and building a wheelchair access ramp *(see also Applied Learning Standards 2 and 5; Mathematics Standards 2 and 3);*
- designing and implementing an induction program for students new to the school, including a handbook and other informational materials *(see also Applied Learning Standard 2);*
- designing and conducting a community survey to inform local council decisions about the future use of a community owned building or resource area *(see also Applied Learning Standards 2, 3, and 5; Mathematics Standards 1 and 4);*
- designing and building a grandfather clock *(see also Science Standard 1);*
- designing and staging a dramatic production *(see also Applied Learning Standards 2, 4, and 5; English Language Arts Standard 5).*

PLANNING AND ORGANIZING

The student plans and organizes an event or activity; that is, the student:

- **develops a plan that:**
  - **reflects research into relevant precedents and regulations;**
  - **includes all the factors and variables that need to be considered;**
  - **makes sense in terms of the order in which things need to be done;**
  - **makes sense in terms of the people, time, and resources available to put the plan into action;**
  - **is described clearly enough for someone else to use it;**
- **implements the plan in ways that:**
  - **reflect established priorities;**
  - **respond effectively to unforeseen circumstances;**
- **evaluates the success of the event or activity, identifying the parts of the plan that worked best and the aspects that could have been improved by better planning and organization, and proposing how the improvements could have been achieved;**
- **makes recommendations to others who might consider planning and organizing a similar event or activity.**

Examples of planning and organizing an event or activity include:

- organizing a science fair *(see also Applied Learning Standard 4; Science Standard 8);*
- staging a dramatic production *(see also Applied Learning Standards 2, 4, and 5; English Language Arts Standard 5);*
- planning a field trip to study an ecosystem *(see also Science Standard 2);*
- organizing a program for providing voluntary services in household help and maintenance to elderly people in the local area *(see also Applied Learning Standard 5);*
- organizing a school carnival *(see also Applied Learning Standard 2; Mathematics Standard 4);*
- organizing a special event for a local organization, such as an awards night or end of season celebration *(see also Applied Learning Standards 2 and 5).*

IMPROVING A SYSTEM

The student troubleshoots problems in the operation of a system in need of repair or devises and tests ways of improving the effectiveness of a system in operation; that is, the student:

- **describes the management and structure of the system in terms of its logic, sequences, and control;**
- **identifies the operating principles underlying the system, i.e., mathematical, scientific, organizational;**
- **analyzes the design and management of the system with reference to its functional, aesthetic, social, commercial, and environmental requirements, as appropriate;**
- **evaluates the operation of the system;**
- **devises strategies for putting the system back in operation or improving its performance;**
- **tests the effectiveness of the strategies employed.**

Examples of troubleshooting problems in the operation of a system or improving the effectiveness of a system in operation include:

- earning the Auto Mechanics Merit Badge (Boy Scouts of America) or completing the Auto Maintenance Project (Girl Scouts of America); *(see also Applied Learning Standard 4; Science Standard 1);*
- improving the system for reserving time on computers during recess and lunch times;
- making recommendations to local officials about ways to improve water quality in the vicinity of the school *(see also Applied Learning Standards 2, 3, and 5; Science Standard 4);*
- developing proposals for reducing both the quantity and cost of waste disposal on the school campus *(see also Mathematics Standard 7; Science Standard 1);*
- proposing ways of re-establishing a neighborhood crime prevention organization that has become defunct.

2. Communication Tools and Techniques

Communicate information and ideas in ways that are appropriate to the purpose and audience through spoken, written, and graphic means of expression.

The student makes an oral presentation of project plans or findings to an audience beyond the school; that is, the student:

- **organizes the presentation in a logical way appropriate to its purpose;**
- **adjusts the style of presentation to suit its purpose and audience;**
- **speaks clearly and presents confidently;**
- **responds appropriately to questions from the audience;**
- **evaluates the effectiveness of the presentation.**

Examples of oral presentations include:

- presenting to the board of a local organization the proposal for a special event to be organized on behalf of the organization *(see also Applied Learning Standards 1 and 5);*
- presenting to the local council results of a community survey designed to inform the council's decisions about future use of a community owned building or resource area *(see also Applied Learning Standards 1, 3, and 5);*
- presenting to a local business plans for a school carnival and a request for assistance in running the event *(see also Applied Learning Standard 1);*
- presenting to representatives of the school district's buildings and maintenance department designs for a wheelchair access ramp *(see also Applied Learning Standards 1 and 5).*

The student conducts formal written correspondence with a community organization or business; that is, the student:

- **expresses the information or request clearly for the purpose and audience;**
- **writes in a style appropriate to the purpose and audience of the correspondence.**

Examples of letters and memos include:

- writing a letter to a museum seeking permission to reproduce artwork in a history periodical for students *(see also Applied Learning Standards 1, 3, 4, and 5);*
- writing a letter to a local business seeking financial support for a school carnival *(see also Applied Learning Standard 1);*
- writing letters to the police and fire departments to advise them of plans for a special event to be conducted on behalf of a local organization and seeking direction regarding safety regulations applicable to the event *(see also Applied Learning Standards 1 and 5).*

The student organizes and communicates information for publication using several methods and formats, such as overhead transparencies, handouts, and computer generated graphs and charts; that is, the student:

- **collects information to include in published materials;**
- **organizes the information into an appropriate form for use in the publication, taking account of the requirements and possibilities of the chosen format;**
- **checks the information for accuracy;**
- **formats the published material so that it achieves its purpose.**

(Communication Tools and Techniques Performance Description continued on next page)

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3. Information Technology Tools and Techniques

(continued)

Examples of writing and formatting information for publication include:

- publishing a program for a dramatic production *(see also Applied Learning Standards 1, 4, and 5)*;
- publishing a brochure advertising the school for new students *(see also Applied Learning Standard 1)*;
- producing overhead transparencies and handouts to support a presentation to the local council on the results of a community survey designed to inform the council's decisions about future use of a community owned building or resource area *(see also Applied Learning Standards 1, 3, and 5)*.

The student translates information from one format to another; that is, the student:

- **chooses a different format that is appropriate for presenting information to better suit the purpose for communicating it;**
- **checks that the information has been translated accurately into the new format;**
- **gives reasons for any changes made in the information, such as deciding to leave some information out.**

Examples of translating information from one format to another include:

- translating from a map to a sketch map drawn to a reduced scale, e.g., using a land survey map to produce a sketch map drawn to smaller scale that highlights issues related to improving water quality *(see also Applied Learning Standards 1, 3, and 5)*;
- translating from statistics to graphics, e.g., using several kinds of graphs to display data collected from a community survey *(see also Applied Learning Standards 1, 2, and 5)*;
- translating a detailed plan into a series of points for an oral presentation, e.g., developing a series of points to guide an oral presentation to the board of a local organization on a proposal for a special event to be organized on behalf of the organization *(see also Applied Learning Standards 1 and 5)*.

4. Learning and Self-management Tools and Techniques

Use information technology to collect, analyze, organize, and present information.

The student:

- **loads, runs, and uses database and spreadsheet programs;**
- **acquires information for specific purposes from on-line sources;**
- **uses documentation and on-screen help to learn how to use software programs.**

Examples of using information technology tools and techniques include:

- loading, running, and using a database program to manage data collected through a community survey *(see also Applied Learning Standards 1, 2, and 5)*;
- using on-line sources to collect information about water quality in nearby areas to inform research into water quality in the local area *(see also Applied Learning Standards 1, 2, and 5)*;
- using documentation and on-screen help to learn how to use a desktop publishing program for producing a history periodical for students *(see also Applied Learning Standards 1, 2, 4, and 5)*.

5. Tools and Techniques for Working With Others

Manage and direct one's own learning.

The student learns from role models; that is, the student:

- **consults with or observes older students and adults at work and identifies the main features of what they do, the way they go about their work, and the qualities of the products they produce;**
- **analyzes work performances and work products to identify factors affecting success;**
- **takes account of analyses of role models in planning and conducting his or her own project activities.**

Examples of learning from role models include:

- examining professionally published journals to inform the design of a history journal for students *(see also Applied Learning Standards 1, 2, 3, and 5)*;
- visiting a professionally organized exhibition to inform planning for a science fair *(see also Applied Learning Standard 1)*;
- making a field trip to study a dramatic production in rehearsal to inform design of the students' own production; interviewing people involved in the production, such as the director, stage manager, lighting director, publicity manager *(see also Applied Learning Standards 1, 2, and 5)*;
- visiting an auto repair shop and studying how a mechanic diagnoses faults in motor vehicles *(see also Applied Learning Standard 1)*.

The student develops and maintains a schedule of work activities; that is, the student:

- **establishes a schedule of work activities that reflects priorities and deadlines;**
- **seeks advice on the management of conflicting priorities and deadlines;**
- **updates the schedule regularly.**

Examples of tools and techniques for developing and maintaining a schedule of work activities include:

- developing daily, weekly, or longer term work plans, as appropriate;
- using timelines to identify conflicting priorities and deadlines and seeking advice on resolving conflicts from teachers, clients, or peers, as appropriate;
- reviewing and revising work plans at the end of each day, week, or other period of time, as appropriate.

The student sets goals for learning and reviews his or her progress; that is, the student:

- **sets goals for learning;**
- **reviews his or her progress towards meeting the goals;**
- **seeks and responds to advice from others in setting goals and reviewing progress.**

Examples of tools and techniques for setting and reviewing learning goals include:

- establishing learning goals in consultation with the teacher and using the goals to inform choices about project activities, e.g., choosing activities that provide opportunities to work towards established goals;
- reviewing work on a completed project in light of established learning goals;
- seeking feedback from teachers, clients, and peers to help set goals and review progress towards meeting them.

Work with others to achieve a shared goal, to promote on-the-job learning, and to respond effectively to the needs of a client.

The student takes responsibility for a component of a team project; that is, the student:

- **reaches agreement with team members on what work needs to be done to complete the task and how the work will be tackled;**
- **takes specific responsibility for a component of the project;**
- **takes all steps necessary to ensure appropriate completion of the specific component of the project within the agreed upon time frame.**

Examples of taking responsibility for a component of a team project include:

- taking responsibility for preparing an article for publication in a history magazine for students *(see also Applied Learning Standards 1, 2, 3, and 4)*;
- taking responsibility for the lighting aspects of a dramatic production *(see also Applied Learning Standards 1, 2, and 4)*;
- taking responsibility for coordinating the analysis of data collected in a community survey *(see also Applied Learning Standards 1, 2, and 3)*.

The student coaches or tutors; that is, the student:

- **assists one or more others to learn on the job, e.g., in school, sports, and community groups;**
- **analyzes coaching or tutoring experience to identify more and less effective ways of providing assistance to support on-the-job learning;**
- **uses the analysis to inform subsequent coaching or tutoring activities.**

Examples of coaching or tutoring include:

- coaching another student in the use of a software program *(see also Applied Learning Standard 3)*;
- coaching a group of younger students undertaking a project;
- tutoring other students in techniques for analyzing water quality *(see also Applied Learning Standards 1, 2, and 3)*.

The student negotiates with a client; that is, the student:

- **consults with a client to clarify the demands of a task;**
- **interprets the client's request and translates it into an initial plan for completing the task, taking account of available resources;**
- **negotiates with the client to arrive at an agreed upon plan.**

Examples of negotiating with a client include:

- negotiating with disabled members of the school community to design a wheelchair access ramp appropriate to their needs *(see also Applied Learning Standards 1 and 2)*;
- negotiating with the board of a local organization to organize a special event on its behalf *(see also Applied Learning Standards 1 and 2)*;
- negotiating with a committee of elderly citizens to organize a program for providing voluntary services *(see also Applied Learning Standard 1)*.

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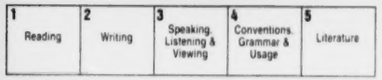
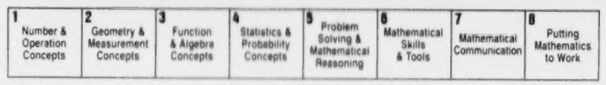
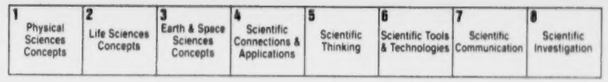
Work Sample & Commentary: *McLean's Got It Going On*



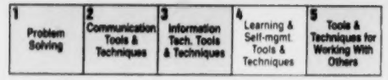
English Language Arts


1 Number & Operation Concepts
2 Geometry & Measurement Concepts
3 Function & Algebra Concepts
4 Statistics & Probability Concepts
5 Problem Solving & Mathematical Reasoning
6 Mathematical Skills & Tools
7 Mathematical Communication
8 Putting Mathematics to Work

Mathematics


1 Physical Sciences Concepts
2 Life Sciences Concepts
3 Earth & Space Sciences Concepts
4 Scientific Connections & Applications
5 Scientific Thinking
6 Scientific Tools & Technologies
7 Scientific Communication
8 Scientific Investigation

Science


1 Problem Solving
2 Communication Tools & Techniques
3 Information Tech. Tools & Techniques
4 Learning & Self-mgmt. Tools & Techniques
5 Tools & Techniques for Working With Others

Applied Learning

The work presented from this project is not a comprehensive record of all work done as part of the project. This is partly because the project was not done with a view to providing evidence of these standards and partly because it would be neither reasonable nor appropriate to ask students to keep detailed written records of every aspect of every project. This would defeat part of the purpose of Applied Learning, which is for students to learn from projects that have strong links to the world of work. Some of these standards better lend themselves to assessment through observation and other less formal methods than through written work.

Accordingly, the range and depth of evidence on which to base commentary related to the standards varies throughout this work sample.

Applied Learning required by the task

Students were asked to develop an informational brochure that could be used for orientation of new students and their parents and for visitors to the school. The task provided students with an opportunity to use and further develop their knowledge of and skills at researching and writing informational materials.

Circumstances of performance

A group of six students was given four weeks to research, draft, field test, revise, and publish the brochure. The writing was a collaborative effort with two students performing the final editing. The teacher gave feedback to the students about content and formatting. Additional advice came from the principal, who negotiated content and appropriate language with the students. The final product was a result of desktop publishing, with the exception of the graphics which were cut and pasted into the brochure prior to publication. Again, the teacher assisted students with columns and placement of text, but the students made final decisions about placement of text and formatting the information. Mass production of the final product was contracted to a local print shop.

This project gave students the opportunity to provide evidence related to the following parts of the Applied Learning standards:

Standard 1, Problem Solving—designing;

Standard 2, Communication Tools and Techniques—organizes and communicates information for publication;

Standard 3, Information Technology Tools and Techniques;

Standard 5, Tools and Techniques for Working With Others—takes responsibility for a specific component of a team project; negotiates with a client.

Problem Solving—Designing

The student designs a product, service, or system to meet an identified need; that is, the student:

- **develops a range of design options;**
- **selects one design option to pursue and justifies the choice, for example, with reference to functional, aesthetic, social, economic, or environmental considerations;**
- **identifies, where relevant, the principles on which the decision was based, such as aesthetic, mathematical, scientific;**
- **uses appropriate conventions to represent the design;**
- **establishes criteria for judging the success of the design;**
- **plans and carries out the steps of the production process;**
- **adjusts the production process as required to achieve specified standards of quality and safety;**
- **evaluates the quality of the design by considering the criteria for success and by comparison with similar products, services, or systems.**

The brochure is a designed product that meets the needs and responds to the request of the principal. To arrive at the design, students reviewed published brochures as models. The credit on the bottom of side one is an attempt to emulate a precedent. Research was required to formulate text. Students were required to sort through earlier school publications and archives. This research was supplemented by interviews with community members. Students field tested early drafts and made revisions in light of the response. The brochure has been widely circulated among parents and students of the school. It has also been used as a model for other middle schools in the district to use in developing similar documents.

This project illustrates an appropriate task for designing at the middle school level, and the finished product provides evidence for the quality of work expected of products arising from comparable kinds of projects. However, the available evidence does not allow for detailed commentary on the students' work in relation to this standard.

Communication Tools and Techniques

The student organizes and communicates information for publication using several methods and formats, such as overhead transparencies, handouts, and computer generated graphs and charts; that is, the student:

- **collects information to include in published materials;**
- **organizes the information into an appropriate form for use in the publication, taking account of the requirements and possibilities of the chosen format;**
- **checks the information for accuracy;**
- **formats the published material so that it achieves its purpose.**

The brochure compiles research from various sources, such as histories, interviews, and prior publications, to form a concise presentation. It supplements the text with graphics as an aid to the reader. The information is organized in a form appropriate for publication in a brochure format. It can be assumed that the information is accurate, because the principal approved its publication. The material is formatted to achieve its purpose.

The brochure provides evidence for the quality of work expected for this part of the standard for Communication Tools and Techniques. To say that a student has met this part of the standard, however, the brochure would need to be accompanied by additional materials of comparable quality demonstrating facility with a variety of methods and formats for organizing and communicating information.

Information Technology Tools and Techniques

The student:

- **loads, runs, and uses database and spreadsheet programs;**
- **uses documentation and on-screen help to learn how to use software programs.**

The brochure is a desktop publication that was word processed. A more sophisticated layout may have been achieved with additional formatting. However, as a novice attempt this example is reasonably competent. For the purposes of this standard, desktop publishing software may be regarded as generally comparable with database and spreadsheet programs. The document uses right justification and columns with gutters for folding. Placement of text allowed for a later inclusion of graphics. The graphics were a result of cutting and pasting prior to printing rather than computer generated drawing.

Tools and Techniques for Working With Others

The student takes responsibility for a component of a team project; that is, the student:

- **reaches agreement with team members on what work needs to be done to complete the task and how the work will be tackled;**
- **takes specific responsibility for a component of the project;**
- **takes all steps necessary to ensure appropriate completion of the specific component of the project within the agreed time frame.**

The brochure was produced by a group of students working collaboratively. Two students took responsibility for editing the text prior to publication. This is an appropriate example of taking responsibility for a component of a team project. It is a reasonably discrete component of the project and the value added by this component is readily identifiable in the final product.

There is no evidence for the processes the students adopted in taking responsibility for the editing component of the project nor evidence for the drafts from which they worked to produce edited copy. However, the published brochure is a product that provides evidence for the quality of work expected at the middle school level for this part of the standard for Tools and Techniques for Working With Others.

The student negotiates with a client; that is, the student:

- **consults with a client to clarify the demands of a task;**
- **interprets the client's request and translates it into an initial plan for completing the task, taking account of available resources;**
- **negotiates with the client to arrive at an agreed upon plan.**

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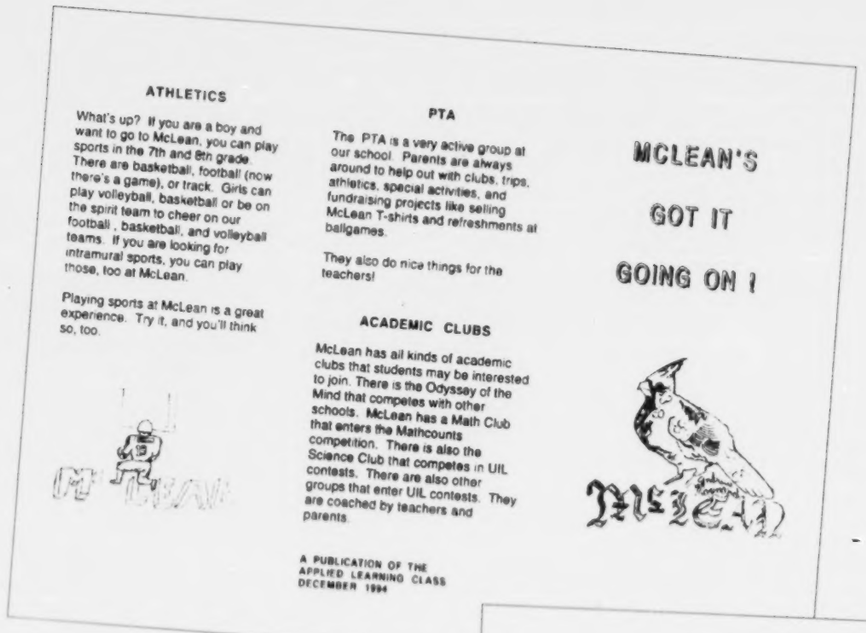
McLean's Got It Going On

The brochure is a result of a request by the principal to write an informative brochure. There is no evidence of the students' negotiations with the principal, although earlier drafts of the final product (not shown here) suggest revisions were made after consulting with the principal. The principal's satisfaction with the plan for the brochure may be inferred from the fact that the brochure was published and is used as part of the school's informational materials. The text that addresses the needs of the intended audience is in direct response to the commission.

The task illustrates an appropriate level of expectation at the middle school level for negotiating with a client.

The brochure contains a few errors, all of which relate to spacing. The narrative text would not provide evidence for English Language Arts Standard 2, Writing. Yet it has a friendly voice, appropriate for the intended audience, that uses words like "cool" and phrases like "putting people in a happy mood" and "singing cheerful songs all day."



ATHLETICS

What's up? If you are a boy and want to go to McLean, you can play sports in the 7th and 8th grade. There are basketball, football (now there's a game), or track. Girls can play volleyball, basketball or be on the spirit team to cheer on our football , basketball, and volleyball teams. If you are looking for intramural sports, you can play those, too at McLean.

Playing sports at McLean is a great experience. Try it, and you'll think so, too.

PTA

The PTA is a very active group at our school. Parents are always around to help out with clubs, trips, athletics, special activities, and fundraising projects like selling McLean T-shirts and refreshments at ballgames.

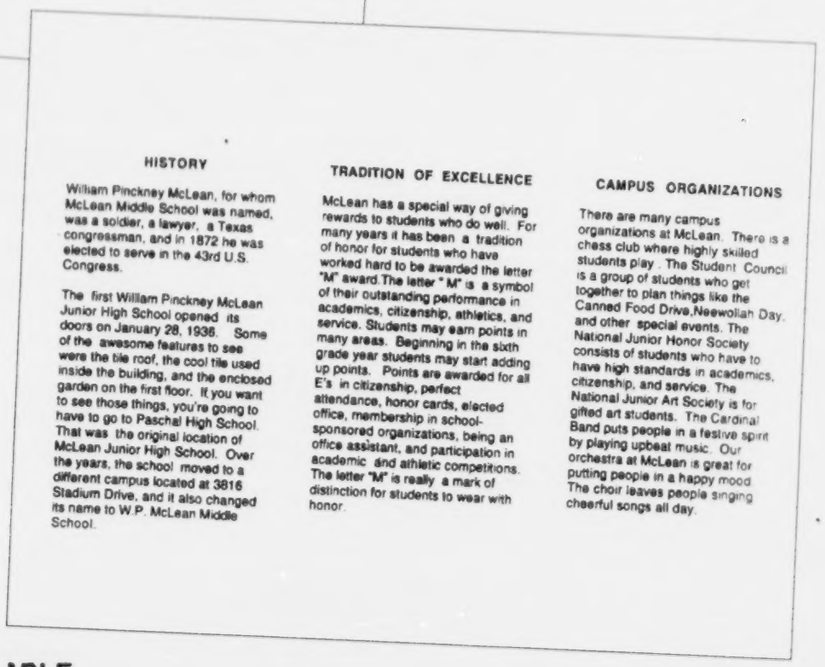
They also do nice things for the teachers!

ACADEMIC CLUBS

McLean has all kinds of academic clubs that students may be interested to join. There is the Odyssay of the Mind that competes with other schools. McLean has a Math Club that enters the Mathcounts competition. There is also the Science Club that competes in UIL contests. There are also other groups that enter UIL contests. They are coached by teachers and parents.

A PUBLICATION OF THE APPLIED LEARNING CLASS DECEMBER 1994

MCLEAN'S GOT IT GOING ON !



HISTORY

William Pinckney McLean, for whom McLean Middle School was named, was a soldier, a lawyer, a Texas congressman, and in 1872 he was elected to serve in the 43rd U.S. Congress.

The first William Pinckney McLean Junior High School opened its doors on January 28, 1936. Some of the awesome features to see were the tile roof, the cool tile used inside the building, and the enclosed garden on the first floor. If you want to see those things, you're going to have to go to Paschal High School. That was the original location of McLean Junior High School. Over the years, the school moved to a different campus located at 3816 Stadium Drive, and it also changed its name to W.P. McLean Middle School.

TRADITION OF EXCELLENCE

McLean has a special way of giving rewards to students who do well. For many years it has been a tradition of honor for students who have worked hard to be awarded the letter "M" award.The letter " M" is a symbol of their outstanding performance in academics, citizenship, athletics, and service. Students may earn points in many areas. Beginning in the sixth grade year students may start adding up points. Points are awarded for all E's in citizenship, perfect attendance, honor cards, elected office, membership in school-sponsored organizations, being an office assistant, and participation in academic and athletic competitions. The letter "M" is really a mark of distinction for students to wear with honor.

CAMPUS ORGANIZATIONS

There are many campus organizations at McLean. There is a chess club where highly skilled students play . The Student Council is a group of students who get together to plan things like the Canned Food Drive,Neewollah Day, and other special events. The National Junior Honor Society consists of students who have to have high standards in academics, citizenship, and service. The National Junior Art Society is for gifted art students. The Cardinal Band puts people in a festive spirit by playing upbeat music. Our orchestra at McLean is great for putting people in a happy mood. The choir leaves people singing cheerful songs all day.

Students in Ontario, Canada are expected to "be able to design and create products, processes, and systems for specific purposes and evaluate them considering such aspects as environmental effects, cost, durability, and visual appeal."

The Common Curriculum, Grades 1-9, p. 79.

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Work Sample & Commentary: *Student Historical Magazines*

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Mathematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	Scientific Connections & Applications	Scientific Thinking	Scientific Tools & Technologies	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

The work presented from this project is not a comprehensive record of all work done as part of the project. This is partly because the project was not done with a view to providing evidence of these standards and partly because it would be neither reasonable nor appropriate to ask students to keep detailed written records of every aspect of every project. This would defeat part of the purpose of Applied Learning, which is for students to learn from projects that have strong links to the world of work. Some of these standards better lend themselves to assessment through observation and other less formal methods than through written work.

Accordingly, the range and depth of evidence on which to base commentary related to the standards varies throughout this work sample.

Applied Learning required by the task

Students on an English/History team design and publish a series of magazines organized around historical themes. The magazines are distributed to middle school students who cannot afford to buy magazines of this kind.

Circumstances of performance

Utilizing funding from a local newspaper grant, students on an English/History team publish a set of historical magazines that provide interesting and informative summer reading materials for designated groups of middle school students who live in low income areas and also have limited access to a variety of reading materials. Based on data gathered from a questionnaire that the class designs, distributes, and collects, the students develop their magazines with the goal of providing historical information in a manner that matches the interest of their adolescent audience. The magazines are organized around historical themes. The themes have to be broad enough to cover several time periods in America's history. The themes selected include presidents, inventions, war, transportation, colleges, environment, art, entertainment, film-making, food, fashions, sports. Next, the students study professional magazines, such as *3-2-1 Contact, Seventeen, Sports Illustrated, Ebony, Zillions, People,* and *National Geographic World* as examples of competent adult performance. The students work in teams, each team using a specific theme. Then each group divides the work required to research and write about its historical theme. Each group also subdivides responsibilities, such as editor, financial manager, art director, and production manager for its magazine. Although each group is unique, all the magazines have common features, including a time capsule, craft kit, personality interview, classical focus, and historically based creative writing.

The History and English teachers serve as consultants and monitors in order to ensure that students accomplish content objectives. The project lasts approximately three months and happens in conjunction with other class work.

This project gave students the opportunity to provide evidence related to the following parts of the Applied Learning standards:

Standard 1, Problem Solving—designing;

Standard 2, Communication Tools and Techniques—organizes and communicates information for publication;

Standard 3, Information Tools and Technology;

Standard 4, Learning and Self-management Tools and Techniques—maintains a work schedule; sets goals for learning and reviews progress;

Standard 5, Tools and Techniques for Working With Others—takes responsibility for a specific component of a team project.

Problem Solving—Designing

The student designs a product, service, or system to meet an identified need; that is, the student:

- **develops a range of design options;**
- **selects one design option to pursue and justifies the choice, for example, with reference to functional, aesthetic, social, economic, or environmental considerations;**
- **identifies, where relevant, the principles on which the decision was based, such as aesthetic, mathematical, scientific;**
- **uses appropriate conventions to represent the design;**
- **establishes criteria for judging the success of the design;**
- **plans and carries out the steps of the production process;**
- **adjusts the production process as required to achieve specified standards of quality and safety;**
- **evaluates the quality of the design by considering the criteria for success and by comparison with similar products, services, or systems.**

Item A is a brief proposal. It establishes that the magazine project is designed to address a specific need and suggests that the project will help both the audience (students receiving the magazine) and the authors publishing the magazine to learn history. The proposal also maintains that the magazines "will provide a source of education for our group as well as the readers." There is no evidence that students developed a range of design options, though **Item B** contains evidence that the students reviewed the design of a number of professionally produced magazines before settling on their own and justifies a number of choices in relation to the design and content of specific articles. It also indicates that students tested the product before launching into final production and made adjustments to improve the quality of several aspects of the magazine: "Once we finished developing our project, we test ran it and evaluated the results by having two groups of people look at it and make comments."

There is also evidence that the students learned about and followed some of the regulations that apply to magazine publication. **Item C** is a letter giving permission to reproduce artwork. **Item D**, the cover of one issue of the magazine, incorporates the reproduced work. **Item K** records the need to obtain permission for photographs (see entry dated 3/30).

This project illustrates a reasonable level of demand for designing a product at the middle school level.

Communication Tools and Techniques

The student organizes and communicates information for publication using several methods and formats, such as overhead transparencies, handouts, and computer generated graphs and charts; that is, the student:

- **collects information to include in published materials;**
- **organizes the information into an appropriate form for use in the publication, taking account of the requirements and possibilities of the chosen format;**
- **checks the information for accuracy;**
- **formats the published material so that it achieves its purpose.**

The materials include several examples of organizing and communicating information for publication using different methods and formats, e.g., the cover of one of the magazines which incorporates headlines to attract the reader to look inside (**Item D**); articles for the magazine (**Items G, H,** and **I**); and a chart prepared to show changes in transportation over time (**Item J**).

Item A

Dear Ms. _____ and Ms. _____

Our Applied Learning group is planning on doing a magazine. It will focus on the subject of modern art in the late nineteenth century to the early twentieth century. We feel that this magazine is a worthwhile project for many reasons. First, this magazine will provide a source of education for our group as well as the readers. We will learn a lot more from our research because our main goal is to inform the reader. The reader will benefit because they will learn throughout this interactive magazine. Second, the magazine will entertain the reader.

This whole project will be a worthwhile experience. We hope that you will consider the ideas that we have setforth throughout this proposal. Thank you for your time.

Sincerely,

Melissa _____ Natalie _____

Dusty _____ Kimberly _____

Janine _____

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Item B

Dear Ms. ____ and Mr. ____:

I had no idea of the magnitude of hard work and effort it takes to do research and endless drafts, artworks, text and layouts. And how difficult it is sometimes to work in a group. Though we encountered some minor and major snags along the way, I was very pleased with the final product and feel that I have learned a lot of valuable lessons and skills as a result of his project.

The first step we had to take in developing our magazine before we even thought of writing articles, was to design it. I first came up with the idea of using entertainment for our theme because on our list of our audience's needs and values, we had entertainment listed as one of the main items. We later developed it to include music, games and television because these are things that we ourselves find interesting. As far as deciding what to include in our magazine goes, we started out by identifying the needs, values, and knowledge of our audience. Each member of our group made their own list and then we combined them during class. After we had a better feeling for who we were writing for, we brought in several magazines, like Seventeen, to compare and to models (See Daily Log, 3/23). Then we each made lists of content and visual items that we liked and wanted to try and include in our own magazine. We noted things like bright headlines, different types of layouts, lots of artwork, varying colors, and easy to follow articles about interesting topics. Our group worked really well together on this aspect and we each contributed about equally to discussions and ideas. After we had the basic format, we had to develop it in all of the main categories. I came up with the idea to do an extra section about interesting and strange facts about the history of television and where it is today, and ended up actually doing it in the end. For the other sections I found it pretty easy to decide what to write about. For example, in the creative writing section I decided to write about a roller coaster because the average teenager likes amusement parks and rides, and for the time capsule I just researched fun and interesting events about the history of television, music, and games. Once we finished the chapters on our interest, we each ran it and evaluated the results by having two groups of people look at it and make comments. Because we got some low marks on original artwork and the creative writing section, I tried to improve the quality of these sections as well as include lots more artwork in my time capsule (See Daily Log, 4/19 and 4/21).

The Andy Warhol Foundation for the Visual Arts

Joanna ____
____ Middle School
____ Way
Fort Worth, TX 761

April 7, 1995

Dear Ms ____:

Thank you for your reproduction request for the Campbell's Soup Can by Andy Warhol. We can certainly honor this request (for no charge), and the copyright line for the work should be:

© 1995 The Andy Warhol Foundation, Inc.

I do not know if you intend to reproduce a painting or a print of this image, so I don't know what caption information you need. If you do need caption information, please let me know more details, and I would be happy to help you out.

For your information (and the kids' education), our normal reproduction requests are honored as follows:

1. People contact me, by fax, with their request. The request must include the image needed, where it would be published, how many copies, is it for one country or international, and how many languages it will be published in.
2. I allow or deny the usage, and to the okayed requests, rent out photographs, material of the artwork, if it is needed.
3. For the okayed requests I then also fax the original letter to the Artists Rights Society, who will contact the client regarding reproduction fees.

Good luck with your publication.

Sincerely,

Beth ____

Beth ____
Rights and Reproductions coordinator

65 BLEECKER STREET, 7TH FLOOR
NEW YORK, NY 10012
TELEPHONE (212) 387-7555
FAX (212) 387-7560

Item C

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Item D

In France, students are expected to complete a technical project "defined in terms of a need to satisfy and a goal to attain, by taking account of diverse conditions and constraints. In order to complete the project, one must collect information, compile documentation, plan a program of action, deal with risks, control for the unexpected, proceed to make choices, use elements of knowledge that belong to different domains, and determine and implement a control process through to completion by integrating the initial concept, successive steps, and envisaged use of the product. Finally, it is necessary to manage one's time."

Collèges: Programmes et Instructions, p. 333.

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Work Sample & Commentary: *Student Historical Magazines* continued

1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Mathematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	Scientific Connections & Applications	Scientific Thinking	Scientific Tools & Technologies	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

Items E, F, and **G** trace the development of a single article from research, both into the topic for the article and into the use of interviews to obtain information, to a transcript of the interview and finally to the completed article for publication. These items provide evidence for collection of information from several sources and organization of the information into a form appropriate to a journalistic article. The article reports the interviewee's words faithfully. It is formatted simply but with reasonable effectiveness for its purpose. Some more ambitious efforts at formatting are evident in **Items I** and **J**.

The articles provide evidence for the quality of work expected for this part of the standard for Communication Tools and Techniques. To say that a student has met this part of the standard, however, any one article would need to be accompanied by additional materials of comparable quality demonstrating facility with a variety of methods and formats for organizing and communicating information.

Information Technology Tools and Techniques

The student:

- **loads, runs, and uses database and spreadsheet programs;**
- **uses documentation and on-screen help to learn how to use software programs.**

The magazines are desktop publications that were word processed. For the purposes of this standard, desktop publishing software may be regarded as generally comparable with database and spreadsheet programs. **Items G, H, I**, and **J** were produced on desktop publishing software.

Several items provide evidence for the students' facility with use of information technology tools and techniques, e.g., the log entry in **Item K** dated 4/4 includes "I do not have Microsoft Publisher, so I will just type the article on Microsoft Works, bring it to school, and merge it into Publisher, tomorrow at school" and the log entry records dated 4/5 include "Today I had disk problems, so my entire article (though format was not changed), was erased. I have to type some papers over during this weekend, to get layouts turned in, in sufficient time."

The nature of the evidence does not provide appropriate information to illustrate this standard clearly.

Item E

Melody
English/History

March 28, 1995

Bibliography for Interview

1. Collier's Encyclopedia Copyright 1972 Crowell-Collier Educational Corporation
Volume USA to ZWINGLI Topic: Vietnam War

Summary: A political and military war fought in the country of Vietnam. War plans, conflicts, and tensions that arose during this war. I just got some information on the war so that the interview with Mr. Fransisco_____ would be smoother.

2. Tell me about yourself - How to Interview by D.L. Mayberry
Copyright © 1985 by Lerner Publications Company

Summary: This book guided me in presenting and doing interviews, (Face to face / Informational) and doing useful and proper research, preparing questions and all the arrangements needed to conduct the interview.

3. Interview Questions (Written by me)
I researched some Vietnam War facts / and questions to ask and this is what I came up with. →

Item F

F.P. - I did attend a Marine Corps Infantry Camp that educated me in academics and the steps to taking measures on the combat field. Also to become an interpreter, had to go to a language school in Vietnam. In the physical training, I had to go to some field training that was tough, but essential.
M.L. - How do you feel about the efforts spent on this war? Were they worth it?
F.P. - Definitely not. The whole deal was based on the fact that certain companies wanted money for their planes or jets, the government wanted to gain something. All the business enterprise all wanted to earn profits from this ridiculous political war. Generals got promoted, new jobs were established in Vietnam and America alike. I believe that the whole effort was a wasted one, but I still fought in it, because I had a duty and a promise to the United States.
M.L. - In the end, how did this war affect your life or any of your loved ones? Did any new relationships form?
F.P. - Yes, definitely. This war affected me for a 'long, long time'. I was all bent out of shape with anger towards the government. I had an immense anger in me that was kept inside for the longest time. I couldn't talk to anybody. To me, there was no one there that understood how I felt. I felt as if the government had treated me like dirt. They didn't seem to give me a chance to decide for my own. Fortunately, I found new friends in special programs for Vietnam veterans. I had the opportunity to talk to lots of people that could relate with the way I felt. In the compound that I was in, most everyone had bad attitudes, because nobody thought that this was a necessary war. The worst thing I saw was how traumatized some people were after they fought in Vietnam. Many had drug or marital problems later.
M.L. - Did your race ever get in your way? Did it receive mixed reactions or ever stand as an obstacle?
F.P. - In getting my education in the schools, I had little problem getting to where I eventually got. If I did, I probably ignored it. I mean, that's what you have to do. When I was in Vietnam, there were mainly blacks, whites, and I was the only Hispanic or Mexican. The people there in the infantry never really bothered me, we were too busy working on a job that we had to do.
M.L. - What would you suggest to a minority or anyone else who wants to join the armed forces?
F.P. - I would just tell them to get the best education that they could get while they are at it. Goofing off is never going to get you anywhere. If you do your best, never hesitate on being the leader. Lead your own crowd if you have to. The leaders of this day and age always get the best jobs in the military. Only the smart, intelligent and hardest working get promoted to the officers' stage. Always keep a positive outlook on the world, because war is one of the most negative things you'll mess with. It can really test you because it is never what you think it is. Just keep that positive outlook on life.

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Interview With the Vet

By Melody

It was a silent night in 1968. The day was rather hot, with some steamy wetness in the tropical Vietnamese climate. The night was a pretty normal one for twenty-one year old Corporal Francisco "Frank" _____. Patrolling had been rather uneventful, and the quiet night air was relaxing for the members of _____'s group. Men silently prowled the grounds amidst the looming compound in Da Nang, Vietnam, watching intently for any signs of disturbance. Cpl. _____ stood still, relaxed, taking it easy after a lonely, difficult day at work. But, how could you ever say that war was easy? The seemingly unnecessary and costly Vietnam War had been going on for several years, and Frank was there to do his job for right now. However, right then, Frank began to get some of his soldiers instinct for danger. He saw that the other soldiers on the patrol had also begun to look up with alertness. The night had grown deathly quiet in a normally noisy part of the land.

Just as Frank decided that it had definitely grown too quiet, whistling mortar shells and booming gunfire shattered the peaceful calm of the compound with shrieking and deafening noises. Everything seemed to be raining down from the pitch black sky, sending with it shards of powder, metal and debris. In the few seconds that all this occurred, Frank suddenly felt a searing, intense pain in his gut, near his stomach. He leaped to the ground for safety as emergency teams got him to the hospital. As he was rushed there, he got scared at the thought of a bullet hitting him. When he entered the

Frank _____ as a young soldier in Vietnam in 1968

emergency room, the medics immediately began looking for the bullet hole, except it was never found. The sudden event had scared Frank so immensely that he had formed a huge ulcer in the pit of his stomach fear gripping him from the real world.

Mr. _____, now age forty-nine, looks back on that incident with a chuckle because he remembers how one of his first encounters scared him thoroughly. Although many followed after that one in that foreign land, he looks back saying, "It scared the heck outta me. I'll never forget that night." That night was one of a lifetime for Frank while he served in the U.S. Marine Corps during the Vietnam War.

Although there were a few good times and a duty to finish out, Mr. _____ never quite got over the fact that this political war was fought for the wrong reasons. In his opinion and other's view on this war, "Everyone was out to profit or gain from this war. Generals got promoted, business boomed for the defense industry, new jobs were made in Vietnam and America alike. I really think that the basic effort of this whole operation was a wasted one." Vietnam was remembered to many as an unnecessary, cruel war that ruined two countries.

But how did this affair start? Well, you could say that it began with the end of World War II. During the reconstruction period after World War II, President Truman and other leaders of America, one of the most powerful nations during that time, wanted to have capitalism, which is when most property is owned privately by people or corporations. Communism was

Item G

Item H

The Peanut Man

George Washington Carver

Captain George Washington Carver of the National Guard at Iowa State University.

A peanut can't be worth much... or so some people think. After all, what can you do with a one-inch long nut other than eat it or feed it to an elephant? George Washington Carver asked himself this and developed 145 ways to use the peanut, such as flour, breakfast foods, imitation coffee, and cosmetics. How could one person think of something as crazy as that?

George Washington Carver was born near Diamond, Missouri in 1864. His parents were slaves, but he found a way out of it and worked his way through high school in Minneapolis, Kansas.

In 1894, Carver graduated from Iowa State University and then joined the faculty as a lab scientist in botany, the study of plant life.

By 1896, he was director of Tuskegee Institute, where he began his studies on sweet potatoes and soy beans. However, because he did not write down any formulas for his products before he died, his products were never manufactured. However, his discoveries and developments influenced southern farmers to raise other crops besides cotton and tobacco, helping the South have an agricultural diversity.

Carver won the Spingarn Medal in 1923, which was given to him by the National Association for the Advancement of Colored People (NAACP). He was also given a high position in the U.S. Department of Agriculture in 1935. Carver gave all his savings to the establishment of the George Washington Carver Foundation of Tuskegee for research on natural science.

On January 5, 1943, he died at Tuskegee. His birthplace is now a national monument.

From now on you can think of George Washington Carver when you pick up a peanut to munch on.

Item I

Dr. James Naismith

"What would you do if someone told you to invent a new game?" James Naismith was told, and he ended up creating one of America's most popular sports.

Basketball, Anyone?

By Maureen

It's most likely that when you're shootin' hoops after school, you don't think about where the game of basketball came from. It was invented more than a hundred years ago by Dr. James Naismith, an instructor at the International YMCA Training School in Springfield, Massachusetts.

It all started when the college's athletic head, Dr. Luther Gulick figured that the students needed something to do in the winter between the football and baseball seasons. It was too cold outside, and there was nothing to do inside. So he asked Naismith to invent a new indoor game.

When Naismith started out, he didn't know what he was going to do. He tried different variations of outdoor sports, but it didn't work. He wanted a game which was not full contact so the players wouldn't get hurt as easily.

He finally got the idea of what we know as basketball. To make it harder, Naismith put the goal above head level.

It was only a matter of teaching the players the game, and he had himself a basketball team. The first demonstration game was played with two peach baskets nailed to opposite ends of the gym wall. The players used a soccer ball, and had thirteen rules to follow. Most of these rules are still used today.

Basketball was an instant success. Everyone started playing-- colleges, YMCA's, high schools, even regular kids just like you. So next time you pick up your basketball, tip your cap to Naismith. You wouldn't be playing if it wasn't for him.

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1	2	3	4	5
Reading	Writing	Speaking, Listening & Viewing	Conventions, Grammar & Usage	Literature

English Language Arts

1	2	3	4	5	6	7	8
Number & Operation Concepts	Geometry & Measurement Concepts	Function & Algebra Concepts	Statistics & Probability Concepts	Problem Solving & Mathematical Reasoning	Mathematical Skills & Tools	Mathematical Communication	Putting Mathematics to Work

Mathematics

1	2	3	4	5	6	7	8
Physical Sciences Concepts	Life Sciences Concepts	Earth & Space Sciences Concepts	Scientific Connections & Applications	Scientific Thinking	Scientific Tools & Technologies	Scientific Communication	Scientific Investigation

Science

1	2	3	4	5
Problem Solving	Communication Tools & Techniques	Information Tech. Tools & Techniques	Learning & Self-mgmt. Tools & Techniques	Tools & Techniques for Working With Others

Applied Learning

Learning and Self-management Tools and Techniques

The student develops and maintains a schedule of work activities; that is, the student:

- **establishes a schedule of work activities that reflects priorities and deadlines;**
- **seeks advice on the management of conflicting priorities and deadlines;**
- **updates the schedule regularly.**

The student sets goals for learning and reviews his or her progress; that is, the student:

- **sets goals for learning;**
- **reviews his or her progress towards meeting the goals;**
- **seeks and responds to advice from others in setting goals and reviewing progress.**

Item K is an example of a work schedule, in this case in the form of a log produced on a daily basis in which each day's record grows out of the previous day's work and closes with tasks established for the next day. The log records work activities associated with two concurrent projects. It would provide a valuable memory aid to assist the process of reviewing progress towards achieving learning goals.

Tools and Techniques for Working With Others

The student takes responsibility for a component of a team project; that is, the student:

- **reaches agreement with team members on what work needs to be done to complete the task and how the work will be tackled;**
- **takes specific responsibility for a component of the project;**
- **takes all steps necessary to ensure appropriate completion of the specific component of the project within the agreed upon time frame.**

Item L provides evidence for students' reaching agreement among team members on the work to be done and how it will be tackled, and for students' taking responsibility for specific components of the project. The evidence does not allow for commentary on the effectiveness of the processes the students adopted.

Taking responsibility for components of the production of a magazine illustrates an appropriate level of demand for taking responsibility for a component of a team project. The components of the project are reasonably discrete and the value added by each component would be readily identifiable in the final product.

Item J

Getting Around From Then To Now

YEAR	TYPE	ADVANTAGES	DISADVANTAGES	HOW IT CHANGED
Prehistoric	Sledge- like a sled of today	carried food and freshly killed prey	heavy and hard to pull	one of first modes of transportation known today
Prehistoric	Travois- like sledge but larger	moved supplies over short distances	awkward to carry- had to be drug along ground	larger and more efficient for carrying food
Ancient	Etrusion Chariot	made good racing vehicle	off balance- only two wheels	developed the first wheels used in Olympics
Ancient	Scythian Oxcart	pulled heavy items	had to have an ox to pull it	had an ox pull it- more on balance
1400's	Ocean liners	went across large areas of water	took a long time- months	could float on water
1600-1700's	Wagons	went long distances	not very sturdy- no motors	had four wheels- could carry a lot
1800's	Horse-drawn car	traveled short distances fast	cost a lot of money to own- had to have a horse	developed many streets in cities and towns
1800's	Locomotive	used steam	had to follow tracks	used steam to operate
Early 1900's	Electric car	no animals	very expensive	no animals' engines
1900's	Zeppelin Airship	flew distances over land	crashed down- killed many people	able to travel through the air
1930's	Ferry	lots of people	short distances	some could carry vehicles
1990's	Planes/jets	fast for long flights	costly- airfare sometimes over $150	uses fuel- travels very fast
1900's	Motor cars	very common	many accidents	many styles

Jennifer

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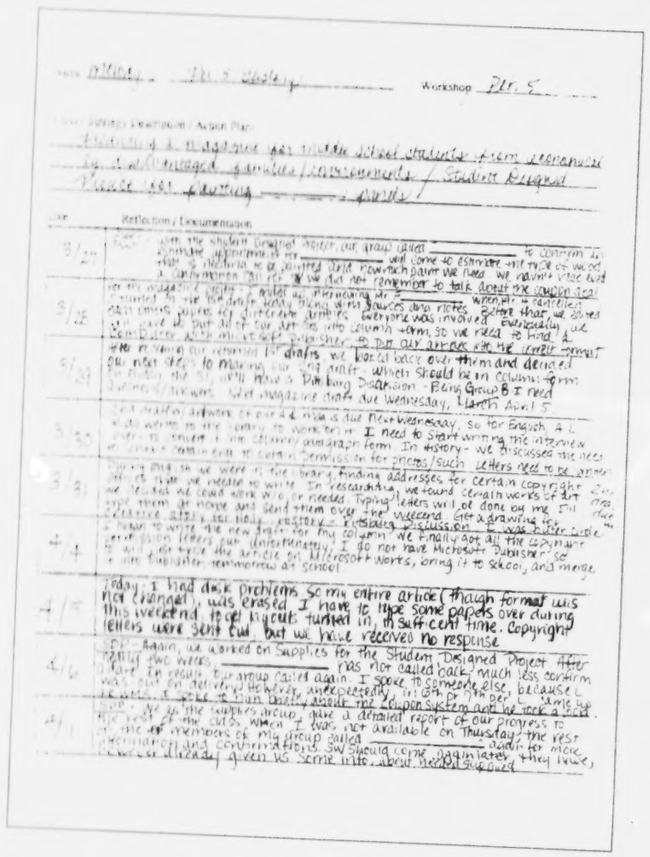
Item K



Workshop Dec. 5

Reflection / Documentation

3/22 — ...the student designed project. our group called ... to discuss ... Everyone appeared to be ... will come to ... with topic or ... topic is ... to be printed ... research paper we have ... we haven't ... but we did not remember to talk about the caption ...

3/25 — ... Everyone was involved ... Everybody ... Currently we are doing ... writing ... sources and notes ... attempt to ... articles ... Agree that we should ... each ... articles. ... all of our ... into columns ... so we need to find a ... Everybody ... we ... Contributes ... to our ... project.

3/29 — ... drafts we ... back over them and ... our next step is to ... our ... draft - which should be in ... form ... Still have a ... Discussion - Being Group B I need ... Next magazine ... due Wednesday, March April 5

... Wednesday, so for Branch A I ... I need to start writing the interview ... to create a ... column form. In history - we discussed the ... ... to obtain permission for pieces such ... letters need to be ...

... we were in the ... finding addresses for certain copyright ... ... to write. In researching, we found certain works of ... ... and send them over the weekend. Got a drawing to ... ... Still ... discussion - ... ... letter ... ... Finally got all the ... ... article on Microsoft Publisher so ... ... at school.

Today I had disk problems so my entire article (though format was not changed), was erased. I have to type some papers over during this weekend to get it/all turned in, in sufficient time. Copyright letters were sent out but we have received no response.

... Again, we worked on supplies for the Student Designed Project after ... two weeks. ... was not called back much less confirm ... to obtain ... group called again. I spoke to someone else, because ... was out on ... However, unexpectedly, in fact ... ... I spoke to ... Both ... assure me ... Chapin System and he took a look ... At the ... group, gave a detailed report of our progress to ... of members of my group called ... available on Thursday - the rest ... and confirmations. We should come again ... for more ... Tuesday, April 16 some info. about ...

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Item L

Division of Responsibilities/Value of project

In our group, we have divided the responsibilities up equally, according to each person's interests. Heather is the Art Director, Jennifer is the Production Manager, Maureen is the Editor, and Alex the Financial Manager.

In the actual magazine, Jennifer and Maureen are working on the time capsule, Alex is doing the craft bit, Heather the interview, Maureen the classical focus, and everyone is contributing to creative writing.

The kids who read this magazine will value it because it will be fun to read and interesting. The articles will be written in a sort of ~~bored~~ entertaining style so they won't get bored. Both our audience and us will appreciate our magazine because inventions and discoveries are an important part of our ever-growing nation.

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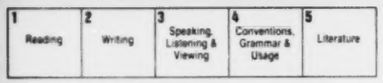
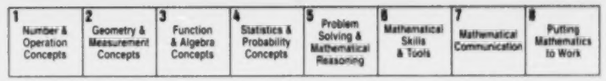
Work Sample & Commentary: *Fall Carnival Project*



English Language Arts


1 Number & Operation Concepts
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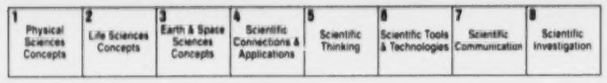
4 Statistics & Probability Concepts
5 Problem Solving & Mathematical Reasoning
6 Mathematical Skills & Tools
7 Mathematical Communication
8 Putting Mathematics to Work

Mathematics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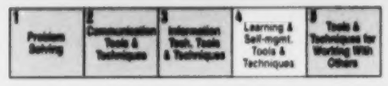
8 Scientific Investigation

Science


1 Problem Solving
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4 Learning & Self-mgmt. Tools & Techniques
5 Tools & Techniques for Working With Others

Applied Learning

The work presented from this project is not a comprehensive record of all work done as part of the project. This is partly because the project was not done with a view to providing evidence of these standards and partly because it would be neither reasonable nor appropriate to ask students to keep detailed written records of every aspect of every project. This would defeat part of the purpose of Applied Learning, which is for students to learn from projects that have strong links to the world of work. Some of these standards better lend themselves to assessment through observation and other less formal methods than through written work.

Accordingly, the range and depth of evidence on which to base commentary related to the standards varies throughout this work sample.

Applied Learning required by the task

Students planned a school carnival. The proceeds were used to buy food for a homeless shelter.

Circumstances of performance

Responding to a proposal from a classmate (see **Item A**), the students decided to sponsor a carnival. The class met with a local professional carnival organizer and also drew upon their own carnival experiences. Then, with the teacher as consultant, the students formed committees for publicity, prizes, donations, procedures, booths, game directions, and tickets. The students invited other campus organizations to participate, but their class was responsible for coordinating the carnival. The project lasted approximately two months, and the students raised $391 to buy food for donation to a local homeless shelter.

This project gave students the opportunity to provide evidence related to the following parts of the Applied Learning standards:

Standard 1, Problem Solving—planning and organizing;

Standard 2, Communication Tools and Techniques—organizes and communicates information for publication; conducts written correspondence;

Standard 3, Information Technology Tools and Techniques;

Standard 5, Tools and Techniques for Working With Others—takes responsibility for a specific component of a team project.

Problem Solving—Planning and Organizing

The student plans and organizes an event or activity; that is, the student:

- **develops a plan that:**
  - **reflects research into relevant precedents and regulations;**
  - **includes all the factors and variables that need to be considered;**
  - **makes sense in terms of the order in which things need to be done;**
  - **makes sense in terms of the people, time, and resources available to put the plan into action;**
  - **is described clearly enough for someone else to use it;**
- **implements the plan in ways that:**
  - **reflect established priorities;**
  - **respond effectively to unforeseen circumstances;**
- **evaluates the success of the event or activity, identifying the parts of the plan that worked best and the aspects that could have been improved by better planning and organization, and proposing how the improvements could have been achieved;**
- **makes recommendations to others who might consider planning and organizing a similar event or activity.**

The evidence does not include a formal plan for the carnival but does include a range of evidence for planning for the event. **Item B** gives information in advance to the charity chosen to receive the food bought with the proceeds of the carnival and includes an invitation to the director of the homeless shelter to attend the event. **Item C** suggests a protocol for participation and confirmation of plans. **Items D** and **E** reflect detailed attention to the factors and variables that need to be considered for an event of this kind. Obtaining the principal's signature on **Item D** indicates attention to regulations. **Item E** includes a plan for what to do in case of rain. **Item G** explains the final accounting procedure used upon completion of the activity, reflecting the school's financial accountability policies.

There is no available evidence for the students' evaluation of the event.

This project illustrates a reasonable level of demand for planning and organizing at the middle school level. While the concept of the event is relatively straightforward, envisaging the event and setting up in advance the arrangements and procedures needed for it to run smoothly places considerable demands on students' planning and organizing skills. These demands were increased by the students' decision to allow other classes and groups in the school to set up booths.

Item A

bring the things for the game corners or make rain. If we have refreshments we could try two other games and popcorn and make cupcakes - cookies, or ourselves to sell. If there is anything else to think of you can do it!
I know it's an expensive project but I think it would be fun.
8/1/94

Mrs. ——,

I'm writing this down for two reasons. One I didn't think of it until after I left your class, and two it'll take to long to explain orally. When you were discussing feeding the people in Somalia I was thinking that we needed to help the people closer to home first. So what I was thinking is that we can get the addresses or addresses of local homeless shelters and have a food drive for them. At the same time raise money for them, for things like blankets, coats, extra food, etc. We could do this by putting together a carnival. We could have it either on the football field or in and around the gym. You could divide the class into groups of two or three and have each group think of a game for the carnival, come up with the prices and prizes, etc. I know it would be expensive so we could either use the school treasury (if there is one) or bring some money ourselves OR

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August 24, 1994

Loaves and Fishes
401 Missoun
Ft. Worth, TX
76104

To Loaves and Fishes,

Our names are _____ and _____. We are from _____ Middle School. Our fifth period reading class is going to have a carnival to raise money to purchase food products to donate to your organization. We are planning to hold the carnival on October 28, 1994 on the baseball field beside our school. We are planning to have all food products that we purchase to you in the first two weeks of November.

On behalf of our class we will take the initiative of inviting you to our carnival at the address of _____, Ft. Worth.

Sincerely,

_____

Remember, the carnival is October 28, from 4:00 to 7:00. We hope to see you there, and you may respond to our request by writing or calling:

Mrs. _____
_____ Middle School

Ft. Worth, Texas

Item B

Item C

GROUP/ORGANIZATION

_____

_____

SPONSOR

_____

_____

WHAT WILL YOUR BOOTH BE?

_____

_____

Item D

RULES AND GUIDELINES
FOR CARNIVAL

DATE-FRIDAY, OCTOBER 28
TIME- 4:15-7:00P.M.
TICKET PRICES- $.25
PICK UP TIME-7:00-7:30P.M.
REASON-ALL PROFITS GO TO BUYING
CANNED FOODS FOR HOMELESS SHELTER (Loaves and Fishes)

1. EVERYTHING MUST BE CLEANED UP BY 7:30P.M.
2. EACH BOOTH MUST CLEAN UP OWN MESS.
3. BOOTHS MUST BE SET UP BY 4:15 P.M.
4. RIVERSIDE STUDENTS AND FAMILY INVITED ONLY.
5. MUST HAVE A WORKER AT BOOTHS AT ALL TIMES.
6. IF POSSIBLE, WE WOULD LIKE A DONATION OF AT LEAST 10% OF PROFITS, (to help buy more food for the homeless shelter)
7. EVERY BOOTH SHOULD COME UP WITH THEIR OWN PRIZES.
8. ALL FOOD MUST BE STORE BOUGHT.
9. EVERYTHING MUST BE PAID FOR WITH TICKETS
10. TICKETS WILL BE TURNED IN FOR CASH AT END OF CARNIVAL.

OUR BOOTHS

1. CAKE WALK
2. GOLF
3. TRICYCLE RACES
4. DUNKING BOOTH
5. REFRESHMENT BOOTH

If your group or organization is interested in participating in this wonderful Fall Carnival, please fill out attached application and return to Mrs. ____ by Friday, September 9. (We know this is a little early, but there are many preparations to make, and we are sure there will be many questions to answer.)

APPROVED _____

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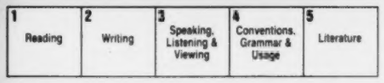
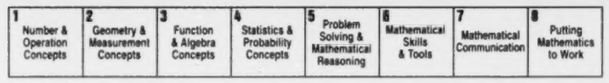
Work Sample & Commentary: *Fall Carnival Project* continued



English Language Arts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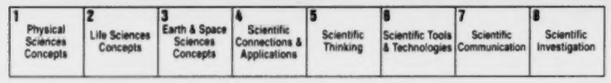
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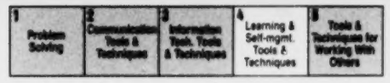
Science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Applied Learning

Communication Tools and Techniques

The student organizes and communicates information for publication using several methods and formats, such as overhead transparencies, handouts, and computer generated graphs and charts; that is, the student:

- **collects information to include in published materials;**
- **organizes the information into an appropriate form for use in the publication, taking account of the requirements and possibilities of the chosen format;**
- **checks the information for accuracy;**
- **formats the published material so that it achieves its purpose.**

The available evidence includes several examples of information for publication presented in the format of a handout. In each case the information has been organized into a form appropriate for use in a handout. The rules and guidelines for the carnival (**Item D**) are brief and to the point. **Item D** suggests that students gave attention to the priority that should be attached to each of the rules as they are listed in an order other than chronological. The procedures set out in **Item E**, on the other hand, cover much of the same information but are organized in a more chronological order as would be appropriate to the needs of booth organizers, the audience for this handout.

The handouts provide evidence for the quality of work expected for this part of the standard for Communication Tools and Techniques. To say that a student has met this part of the standard, however, the work would need to be accompanied by additional materials of comparable quality demonstrating facility with a variety of methods and formats for organizing and communicating information.

The student conducts formal written correspondence with a community organization or business; that is, the student:

- **expresses the information or request clearly for the purpose and audience;**
- **writes in a style appropriate to the purpose and audience of the correspondence.**

Item B is an example of formal correspondence with a community organization or business; in this case, the charity the class selected to be the recipient of the food bought with the funds raised at the carnival. The letter communicates information in a way clearly consistent with its purpose but mixes memo and letter formats when a letter format would have been more appropriate.

Information Technology Tools and Techniques

The student:

- **loads, runs, and uses database and spreadsheet programs;**
- **uses documentation and on-screen help to learn how to use software programs.**

The students used a range of tools and techniques to produce documents related to the project, e.g., in **Item C** a computer graphics program is used to create documents for collecting information and sorting according to types; **Item E** provides information to reinforce the procedures to be followed; the letter (**Item B**) and financial report (**Item G**) were produced by word processing.

These materials are appropriate for this project but do not provide evidence for Information Technology Tools and Techniques at the middle school level.

Tools and Techniques for Working With Others

The student takes responsibility for a component of a team project; that is, the student:

- **reaches agreement with team members on what work needs to be done to complete the task and how the work will be tackled;**
- **takes specific responsibility for a component of the project;**
- **takes all steps necessary to ensure appropriate completion of the specific component of the project within the agreed upon time frame.**

The class acted on the strategy proposed in **Item A** and divided into "groups of two or three" in order to attend to all the details necessary to implement the activity. Different groups were responsible for different tasks, for example, taking charge of the various booths referred to in **Items D**, **E**, and **F** and corresponding with the charity chosen by the class as shown in **Item B**.

This task illustrates an appropriate level of expectation for taking responsibility for a component of a team project. However, the available evidence does not allow for detailed commentary on the students' work related to this part of the standard for Tools and Techniques for Working With Others.

Some of the written materials contain errors. **Item A** is a first draft and has several errors, including "to long" which should be written "too long" and "At the same time...coats, extra food, etc." which is a fragment.

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Item E

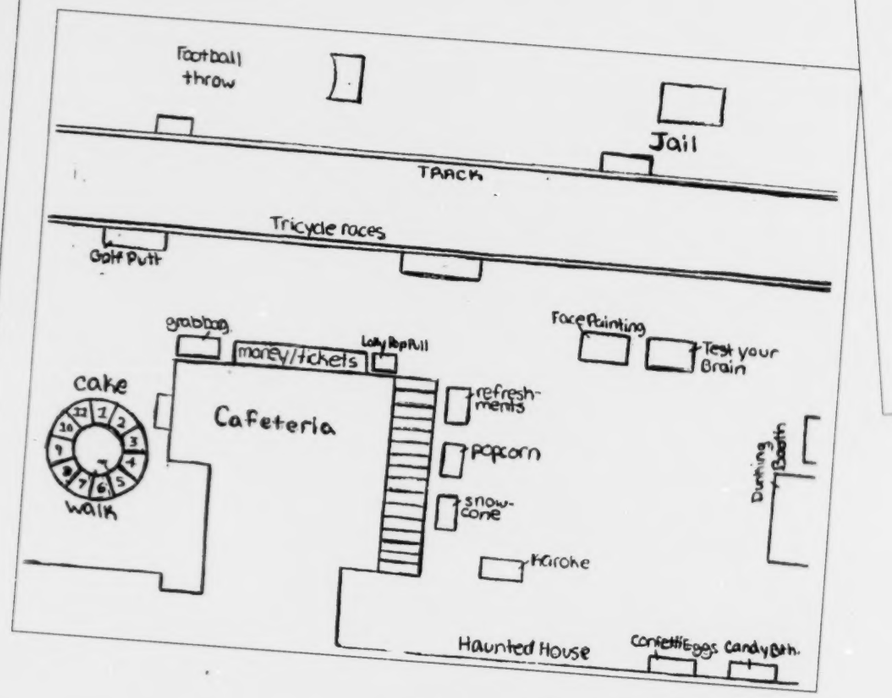
The carnival is almost here, and there are a few details left to go over.

1. All booths must be set up by 4:15.
2. Tables will be set up in your space; all you have to do is decorate.
3. We need to have adults at each booth or in the close proximity (near).
4. No money is to be accepted at the booths. You may accept TICKETS ONLY! Tickets may be purchased at the ticket booth.
5. All "used" tickets are to be torn or marked to prevent "re-using".
6. Turn in all tickets to the money booth at the end of the carnival. The money for the tickets will be given to the sponsor on Monday.
7. All booths must be cleaned up by 7:30! Please, assist us by returning the tables to the cafeteria and picking up all trash.
8. Attached is a map of the carnival grounds. In case of rain, we will be moving inside the new gym.

If you have any questions, please see Mrs. _____ in room 226.

Suggestion: Have a timetable set up for the workers of your booth. This will allow workers a break to see the carnival.

Item F



Item G

Carnival Results

	# of tickets	Money
Student Council	321	80.25
NJHS	150	37.50
Cheerleaders	152	38.00
M&M's	476	119.00
Stars	648	162.00
Eagles	602	150.50
Applied Learning (Goes into Eagles Account)	1564	391.00
Washington, D.C.	1609	402.25
	Total	1380.50

These totals will be deposited in your school accounts. Mrs. _____ needs an account of any expenses incurred, so that she can do any reimbursements necessary. Any expenses will be deducted from your account.

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1. Reading

APPENDIX 1

The elementary school standards are set at a level of performance approximately equivalent to the end of fourth grade. The middle school standards are set at a level of performance approximately equivalent to the end of eighth grade. The high school standards are set at a level of performance approximately equivalent to the end of tenth grade. It is expected that some students might achieve these levels earlier and others later than these grades.

An array of work is required to achieve any single standard. The work becomes increasing refined and sophisticated as students get older. The complexity of the tasks used to generate the work also increases. This notion of requiring students to hone the sophistication of their performances while simultaneously working with increasingly complex assignments cuts across all the English Language Arts standards.

The number of books required to meet this standard does not increase as students get older, but the length and complexity of what is read does increase, so, this standard becomes increasingly formidable.

The reading requirement assumes an adequate library of appropriate reading material. In some places, library resources are too meager to support the amount of reading required for every student to achieve this standard. Where a shortage of books exists, better use of out-of-school resources must be made; for example, students may have to be assured access to local or county libraries.

Reading twenty-five books a year entails a substantial amount of time. Students may use materials read in conjunction with their regular class work, including courses other than English, to satisfy this requirement.

ELEMENTARY SCHOOL

The student reads and comprehends material of the quality and complexity illustrated in the sample reading list equivalent to twenty-five books each year. The materials should include traditional and contemporary children's literature or the equivalent in children's magazines, newspapers, textbooks, and media, from at least three different literary forms and from at least five different writers. The student produces evidence of reading that:

- demonstrates a thorough understanding of the text as a whole;
- identifies complexities presented in the text, i.e., ideas, information, levels of meaning;
- extracts salient information from the text;
- uses paraphrasing judiciously.

The student reads in depth at least four books (or book equivalents) about one issue or subject, or four books by a single writer, or four books in one genre, and produces evidence of reading that:

- makes and supports warranted and responsible assertions about the texts;
- supports assertions with elaborated and convincing evidence;
- makes perceptive and well developed connections;
- evaluates writing strategies and elements of the author's craft.

The student reads informational materials to develop understanding and expertise and produces written or oral work that:

- restates or summarizes information;
- relates new information to prior knowledge and experience;
- extends ideas;
- makes connections to related topics or information.

The student reads aloud, accurately (in the range of 85-90%), familiar material of the quality and complexity illustrated in the sample reading list, and in a way that makes meaning clear to listeners by:

- self correcting when subsequent reading indicates an earlier miscue;
- using a range of cueing systems, e.g., phonics and context clues, to determine pronunciation and meanings;
- reading with a rhythm, flow, and meter that sounds like everyday speech.

MIDDLE SCHOOL

The student reads and comprehends material of the quality and complexity illustrated in the sample reading list equivalent to twenty-five books each year. The materials should include traditional and contemporary literature or the equivalent in magazines, newspapers, textbooks, and media, from at least three different literary genres and from at least five different writers. The student produces evidence of reading that:

- demonstrates a thorough understanding of the text as a whole;
- identifies complexities presented in the text, i.e., ideas, information, levels of meaning;
- extracts salient information from the text;
- uses paraphrasing judiciously.

The student reads in depth at least four books (or book equivalents) about one issue or subject, or four books by a single writer, or four books in one genre, and produces evidence of reading that:

- makes and supports warranted and responsible assertions about the texts;
- supports assertions with elaborated and convincing evidence;
- makes perceptive and well developed connections;
- evaluates writing strategies and elements of the author's craft.

The student reads informational materials to develop understanding and expertise and produces written or oral work that:

- restates or summarizes information;
- relates new information to prior knowledge and experience;
- extends ideas;
- makes connections to related topics or information.

The student demonstrates familiarity with a variety of public documents and produces written or oral work that:

- identifies the author's purpose and stance;
- analyzes the arguments and positions advanced and the evidence offered in support of them;
- identifies common persuasive techniques.

The student demonstrates familiarity with a variety of functional documents and produces written or oral work that:

- identifies the sequence of activities needed to carry out a procedure;
- analyzes the formatting techniques used to make a document user-friendly;
- identifies any information that is either extraneous or missing.

HIGH SCHOOL

The student reads and comprehends material of the quality and complexity illustrated in the sample reading list equivalent to twenty-five books each year. The materials should include traditional and contemporary literature or the equivalent in magazines, newspapers, textbooks, and media, from at least three different literary genres and from at least five different writers. The student produces evidence of reading that:

- demonstrates a thorough understanding of the text as a whole;
- identifies complexities presented in the text, i.e., ideas, information, levels of meaning;
- extracts salient information from the text;
- uses paraphrasing judiciously.

The student reads in depth at least four books (or book equivalents) about one issue or subject, or four books by a single writer, or four books in one genre, and produces evidence of reading that:

- makes and supports warranted and responsible assertions about the texts;
- supports assertions with elaborated and convincing evidence;
- makes perceptive and well developed connections;
- evaluates writing strategies and elements of the author's craft.

The student reads informational materials to develop understanding and expertise and produces written or oral work that:

- restates or summarizes information;
- relates new information to prior knowledge and experience;
- extends ideas;
- makes connections to related topics or information.

6. Public Documents

The student produces at least one public document, in which the writer:

- exhibits an awareness of the importance of precise word choice and the power of imagery and/or anecdote;
- utilizes and recognizes the power of logical arguments, arguments based on appealing to a reader's emotions, and arguments dependent upon the writer's persona;
- uses arguments that are appropriate in terms of the knowledge, values, and degree of understanding of the intended audience;
- uses a range of strategies to appeal to readers.

The student critiques at least one public document, with an eye to strategies common in public discourse, including:

- effective use of argument;
- use of the power of anecdote;
- anticipation of counter claims;
- appeal to audiences both friendly and hostile to the position presented;
- use of emotionally laden words and imagery;
- citing of appropriate references or authorities.

7. Functional Documents

The student produces at least one functional document, appropriate to audience and purpose, in which the writer:

- reports, organizes, and conveys information and ideas accurately;
- includes relevant narrative details, such as scenarios, definitions, examples;
- anticipates readers' problems, mistakes, and misunderstandings;
- uses a variety of formatting techniques, including headings, subordinate terms, foregrounding of main ideas, hierarchical structures, graphics, and color;
- establishes a persona that is consistent with the document's purpose;
- employs word choices that are consistent with the persona and appropriate for the intended audience.

The student critiques at least one functional document, with an eye to strategies common to good functional documents, including:

- visual appeal, e.g., format, graphics, white space, headers;
- logic of the sequence in which the directions are given;
- awareness of possible reader misunderstandings.

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ELEMENTARY SCHOOL

Fiction:
Brink, *Caddie Woodlawn;*
Cleary, *Ramona and Her Father;*
Coerr, *The Josefina Story Quilt;*
Cohen, *Fat Jack;*
De Saint-Exupery, *The Little Prince;*
Hamilton, *Zeely;*
Hansen, *The Gift-Giver;*
Lord, *In the Year of the Boar and Jackie Robinson;*
Mendez and Byard, *The Black Snowman;*
Naidoo, *Journey to Jo'Burg;*
O'Dell, *Zia;*
Ringgold, *Tar Beach;*
Speare, *The Sign of the Beaver;*
Yep, *Child of the Owl.*

Non-Fiction:
Aliki, *Corn Is Maize: The Gift of the Indians;*
Baylor, *The Way to Start a Day;*
Cherry, *The Great Kapok Tree;*
Epstein, *History of Women in Science for Young People;*
Greenfield, *Childtimes: A Three-Generation Memoir;*
Godkin, *Wolf Island;*
Hamilton, *Anthony Burns: The Defeat and Triumph of a Fugitive Slave;*
McKissack, *Frederick Douglass: The Black Lion;*
Politi, *Song of the Swallows;*
Sattler, *Dinosaurs of North America;*
Fritz, *And Then What Happened, Paul Revere?;*
McGovern, *The Secret Soldier: The Story of Deborah Sampson.*

Poetry:
Ahlberg, *Heard It in the Playground;*
Blishen and Wildsmith, *Oxford Book of Poetry for Children;*
De Regniers, Moore, White, and Carr, eds., *Sing a Song of Popcorn;*
Giovanni, *Ego-Tripping and Other Poems for Young People;*
Greenfield, *Honey, I Love and Other Love Poems;*
Heard, *For the Good of the Earth and Sun;*
Janeczko, *Strings: A Gathering of Family Poems;*
Koch and Farrell, eds., *Talking to the Sun;*
Lobel, ed., *The Random House Book of Mother Goose;*
Manguel, ed., *Seasons;*
Mathis, *Red Dog, Blue Fly: Football Poems;*
Silverstein, *Where the Sidewalk Ends.*

Folklore:
Griego y Maestas, *Cuentos: Tales From the Hispanic Southwest;*
French, *Snow White in New York;*
Huck and Lobel, *Princess Furball;*
Louie and Young, *Yeh-Shen: A Cinderella Story From China;*
Luenn, *The Dragon Kite;*
Goble, *Buffalo Woman;*
Steptoe, *Mufaro's Beautiful Daughters;*
Steptoe, *The Story of Jumping Mouse;*
Kipling, *The Elephant's Child;*
Lee, *Legend of the Milky Way.*

Modern Fantasy and Science Fiction:
Andersen, *The Ugly Duckling;*
Bond, *A Bear Called Paddington;*
Dahl, *James and the Giant Peach;*
Grahame, *The Wind in the Willows;*
Lewis, *The Lion, The Witch and The Wardrobe;*
Norton, *The Borrowers;*
Van Allsburg, *Jumanji;*
White, *Charlotte's Web.*

Children's magazines:
Weekly Reader;
Creative Classroom;
Social Studies for the Young Learner;
World (National Geographic);
News (Scholastic);
Action (Scholastic);
Local newspapers or their equivalents.

Other: Manuals appropriate for elementary school children, e.g., Nintendo; other computer manuals.

MIDDLE SCHOOL

Fiction:
Anaya, *Bless Me, Ultima;*
Armstrong, *Sounder;*
Bonham, *Durango Street;*
Cohen, *Tell Us Your Secret;*
Collier, *My Brother Sam Is Dead;*
Cormier, *I Am the Cheese;*
Danziger, *The Cat Ate My Gymsuit;*
Fast, *April Morning;*
Gaines, *A Gathering of Old Men;*
Goldman, *The Princess Bride;*
Greene, *Summer of My German Soldier;*
Hansen, *Which Way Freedom;*
Hinton, *The Outsiders;*
Holman, *Slake's Limbo;*
London, *The Call of the Wild;*
Mathis, *Listen for the Fig Tree;*
Mohr, *Nilda;*
Neufeld, *Lisa, Bright and Dark;*
O'Brien, *Z for Zachariah;*
Reiss, *The Upstairs Room;*
Schaefer, *Shane;*
Stevenson, *Treasure Island;*
Voigt, *Dicey's Song;*
Walker, *To Hell With Dying;*
Walter, *Because We Are;*
Zindel, *The Pigman.*

Non-Fiction:
Amory, *The Cat Who Came for Christmas;*
Berck, *No Place to Be: Voices of Homeless Children;*
Frank, *The Diary of a Young Girl;*
George, *The Talking Earth;*
Gilbreth, *Cheaper by the Dozen;*
Haskins, *Outward Dreams;*
Hautzig, *Endless Steppe: A Girl in Exile;*
Herriott, *All Creatures Great and Small;*
Lester, *To Be a Slave;*
Meyers, *Pearson, a Harbor Seal Pup;*
Soto, *Living Up the Street;*
White, *Ryan White: My Own Story;*
Yates, *Amos Fortune, Free Man.*

Poetry:
Adams, *Poetry of Earth and Sky;*
Eliot, *Old Possum's Book of Practical Cats;*
Frost, *You Come Too;*
Greenfield, *Night on Neighborhood Street;*
Livingston, *Cat Poems.*

Drama:
Blinn, *Brian's Song;*
Davis, *Escape to Freedom;*
Gibson, *The Miracle Worker;*
Lawrence and Lee, *Inherit the Wind;*
Osborn, *On Borrowed Time;*
Shakespeare, *A Midsummer Night's Dream;*
Stone, *Metamora, or, the Last of the Wampanoags.*

Folklore/Mythology:
Blair, *Tall Tale America;*
Bruchac, *The First Strawberries: A Cherokee Story;*
Bryan, *Beat the Story-Drum, Pum-Pum;*
D'Aulaire, *Norse Gods and Giants;*
Gallico, *The Snow Goose;*
Lee, *Toad Is the Uncle of Heaven: A Vietnamese Folk Tale;*
Pyle, *Merry Adventures of Robin Hood.*

Modern Fantasy and Science Fiction:
Bradbury, *Dandelion Wine;*
Babbitt, *Tuck Everlasting;*
Cooper, *The Grey King;*
Hamilton, *The Magical Adventures of Pretty Pearl;*
L'Engle, *A Wrinkle in Time;*
Tolkien, *The Hobbit;*
Yep, *Dragon of the Lost Sea.*

Magazines/Periodicals:
Scope (Scholastic);
World (National Geographic);
Junior Scholastic (Scholastic);
Science World (Scholastic);
Cobblestone (American history);
Calliope (world history);
Faces (anthropology);
Odyssey (science).

Other: Computer manuals; instructions; contracts. See also the reading lists included in award books corresponding to reading provided by the Girl Scouts of America and the Boy Scouts of America.

HIGH SCHOOL

Fiction:
Brito, *The Devil in Texas;*
Carroll, *Alice in Wonderland;*
Cisneros, *The House on Mango Street;*
Clark, *The Ox-Bow Incident;*
Golding, *Lord of the Flies;*
Hawthorne, *The Scarlet Letter;*
Hemingway, *For Whom the Bell Tolls;*
Hentoff, *The Day They Came to Arrest the Book;*
Hilton, *Goodbye, Mr. Chips;*
Kinsella, *Shoeless Joe;*
Knowles, *A Separate Peace;*
Lee, *To Kill a Mockingbird;*
McCullers, *The Heart Is a Lonely Hunter;*
Orwell, *1984;*
Paulsen, *Canyons;*
Portis, *True Grit;*
Potok, *Davita's Harp;*
Steinbeck, *Travels With Charley in Search of America;*
Wartski, *A Boat to Nowhere;*
Welty, *The Golden Apples.*

Non-Fiction:
Angell, *Late Innings;*
Angelou, *I Know Why the Caged Bird Sings;*
Ashe, *Days of Grace;*
Beal, *"I Will Fight No More Forever": Chief Joseph and the Nez Perce War;*
Bishop, *The Day Lincoln Was Shot;*
Bloom, *The Closing of the American Mind;*
Campbell, *The Power of Myth;*
Covey, *Seven Habits of Highly Effective People;*
Galarza, *Barrio Boy;*
Hawking, *A Brief History of Time;*
Houston, *Farewell to Manzanar;*
Kennedy, *Profiles in Courage;*
Kingsley and Levitz, *Count Us In: Growing Up With Down Syndrome;*
Kingston, *Woman Warrior;*
Mazer, ed., *Going Where I'm Coming From;*
Momaday, *The Way to Rainy Mountain;*
Rodriquez, *Hunger of Memory;*
Sternberg, *User's Guide to the Internet;*
Wright, *Black Boy.*

Poetry:
Angelou, *I Shall Not be Moved;*
Bly, ed., *News of the Universe;*
Cummings, *Collected Poems;*
Dickinson, *Complete Poems;*
Randall, ed., *The Black Poets;*
Carruth, ed., *The Voice That Is Great Within Us;*
Hughes, *Selected Poems;*
Knudson and Swenson, eds., *American Sports Poems;*
Longfellow, *Evangeline;*
Wilbur, *Things of This World.*

Drama:
Christie, *And Then There Were None;*
Hansberry, *A Raisin in the Sun;*
McCullers, *The Member of the Wedding;*
Pomerance, *The Elephant Man;*
Rose, *Twelve Angry Men;*
Rostand, *Cyrano de Bergerac;*
Shakespeare, *Romeo and Juliet; Julius Caesar;*
Van Druten, *I Remember Mama;*
Wilder, *The Skin of Our Teeth;*
Wilson, *The Piano Lesson.*

Folklore/Mythology:
Evslin, *Adventures of Ulysses;*
Pinsent, *Greek Mythology;*
Stewart, *The Crystal Cave;*
Burland, *North American Indian Mythology;*
White, *The Once and Future King.*

Modern Fantasy and Science Fiction:
Adams, *Watership Down;*
Asimov, *Foundation;*
Bradbury, *The Martian Chronicles;*
Clarke, *2001: A Space Odyssey;*
Clarke, *Childhood's End;*
Frank, *Alas, Babylon;*
Herbert, *Dune;*
Lewis, *Out of the Silent Planet;*
McCaffrey, *Dragonflight;*
Twain, *A Connecticut Yankee in King Arthur's Court;*
Verne, *20,000 Leagues Under the Sea.*

Magazines and Newspapers:
Omni;
Sports Illustrated;
Literary Cavalcade (Scholastic);
National Geographic;
Smithsonian;
Newsweek;
Time.

Other: Computer manuals; instructions; contracts; technical materials.

APPENDIX 1

These standards allow for oral performances of student work whenever appropriate.

Much writing can be classified as belonging to the public arena. New Standards, however, defines public documents to mean only those pieces of text that are concerned with public policy, that address controversial issues confronting the public, or that arise in response to controversial issues or public policy. Public documents are included in the Reading standard at middle school and constitute a separate standard at high school. At the middle school level, the issues students write about come primarily from the school or local community. At high school, students should address issues which are of national importance.

Functional writing is writing that exists in order to get things done. Functional writing is ordinarily considered technical writing and, as such, is often not part of the typical English curriculum. New Standards requires students to demonstrate proficiency with functional writing because such writing is of increasing importance to the complex literacy of our culture. Functional documents are included in the Reading standard at middle school and constitute a separate standard, Standard 7, at high school.

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APPENDIX 1

The "response to literature" in the Writing standard is meant to replace the more typical literary analysis paper that many students routinely produce in conjunction with literature study. This does not preclude literary analysis but instead opens up possibilities for reader response as well.

It is not intended that all student work developed to meet the English Language Arts standards should necessarily come from an English class. The challenge is to ensure that Mathematics, Science, and Applied Learning work samples are incorporated widely into the English Language Arts work samples, thus encouraging students to use work from other classes while not weakening the English curriculum.

ELEMENTARY SCHOOL

The student produces four types of writing.

A report, in which the writer:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- develops a controlling idea that conveys a perspective on the subject;
- creates an organizing structure appropriate to a specific purpose, audience, and context;
- includes appropriate facts and details;
- excludes extraneous and inappropriate information;
- uses a range of appropriate strategies, such as providing facts and details, describing or analyzing the subject, and narrating a relevant anecdote.

A response to literature, in which the writer:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- advances a judgment that is interpretive, analytic, evaluative, or reflective;
- supports a judgment through references to the text, references to other works, authors, or non-print media, or references to personal knowledge;
- demonstrates understanding of the literary work.

A narrative account (fictional or autobiographical), in which the writer:

- engages the reader by establishing a context, creating a point of view, and otherwise developing reader interest;
- establishes a situation, plot, point of view, setting, and conflict (and for autobiography, the significance of events);
- creates an organizing structure;
- includes sensory details and concrete language to develop plot and character;
- excludes extraneous details and inconsistencies;
- develops complex characters;
- uses a range of appropriate strategies, such as dialogue and tension or suspense.

A narrative procedure, in which the writer:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- provides a guide to action that anticipates a reader's needs, creates expectations through predictable structures, e.g., headings, and provides transitions between steps;
- makes use of appropriate writing strategies, such as creating a visual hierarchy and using white space and graphics as appropriate;
- includes relevant information;
- excludes extraneous information;
- anticipates problems, mistakes, and misunderstandings that might arise for the reader.

MIDDLE SCHOOL

The student produces five types of writing.

A report, in which the writer:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- develops a controlling idea that conveys a perspective on the subject;
- creates an organizing structure appropriate to purpose, audience, and context;
- includes appropriate facts and details;
- excludes extraneous and inappropriate information;
- uses a range of appropriate strategies, such as providing facts and details, describing or analyzing the subject, narrating a relevant anecdote, comparing and contrasting, naming, and explaining benefits or limitations.

A response to literature, in which the writer:

- engages the reader through establishing a context, creating a persona, and otherwise developing reader interest;
- advances a judgment that is interpretive, analytic, evaluative, or reflective;
- supports a judgment through references to the text, references to other works, authors, or non-print media, or references to personal knowledge;
- demonstrates an understanding of the literary work;
- anticipates and answers a reader's questions.

A narrative account (fictional or autobiographical), in which the writer:

- engages the reader by establishing a context, creating a point of view, and otherwise developing reader interest;
- establishes a situation, plot, point of view, setting, and conflict (and for autobiography, the significance of events and of conclusions that can be drawn from those events);
- creates an organizing structure;
- includes sensory details and concrete language to develop plot and character;
- excludes extraneous details and inconsistencies;
- develops complex characters;
- uses a range of appropriate strategies, such as dialogue, tension or suspense, naming, and specific narrative action, e.g., movement, gestures, expressions.

A narrative procedure, in which the writer:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- provides a guide to action for a relatively complicated procedure in order to anticipate a reader's needs, creates expectations through predictable structures, e.g., headings, and provides smooth transitions between steps;
- makes use of appropriate writing strategies, such as creating a visual hierarchy and using white space and graphics as appropriate;
- includes relevant information;
- excludes extraneous information;
- anticipates problems, mistakes, and misunderstandings that might arise for the reader.

A persuasive essay, in which the writer:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- develops a controlling idea that makes a clear and knowledgeable judgment;
- creates an organizing structure that is appropriate to the needs, values, and interests of a specified audience, and arranges details, reasons, examples, and anecdotes effectively and persuasively;
- includes appropriate information and arguments and excludes information and arguments that are irrelevant;
- anticipates and addresses reader concerns and counter arguments;
- supports arguments with detailed evidence, citing sources of information as appropriate.

HIGH SCHOOL

The student produces six types of writing.

A report, in which the writer:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- develops a controlling idea that conveys a perspective on the subject;
- creates an organizing structure appropriate to purpose, audience, and context;
- includes appropriate facts and details;
- excludes extraneous and inappropriate information;
- uses a range of appropriate strategies, such as providing facts and details, describing or analyzing the subject, narrating a relevant anecdote, comparing and contrasting, naming, explaining benefits or limitations, demonstrating claims or assertions, and providing a scenario to illustrate.

A response to literature, in which the writer:

- engages the reader through establishing a context, creating a persona, and otherwise developing reader interest;
- advances a judgment that is interpretive, analytic, evaluative, or reflective;
- supports a judgment through references to the text, references to other works, authors, or non-print media, or references to personal knowledge;
- demonstrates understanding of the literary work through suggesting an interpretation;
- anticipates and answers a reader's questions;
- recognizes possible ambiguities, nuances, and complexities.

A narrative account (fictional or autobiographical), in which the writer:

- engages the reader by establishing a context, creating a point of view, and otherwise developing reader interest;
- establishes a situation, plot, point of view, setting, and conflict (and for autobiography, the significance of events and of conclusions that can be drawn from those events);
- creates an organizing structure;
- includes sensory details and concrete language to develop plot and character;
- excludes extraneous details and inconsistencies;
- develops complex characters;
- uses a range of appropriate strategies, such as dialogue, tension or suspense, naming, pacing, and specific narrative action, e.g., movement, gestures, expressions.

A narrative procedure, in which the writer:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- provides a guide to action for a complicated procedure in order to anticipate a reader's needs; creates expectations through predictable structures, e.g., headings; and provides smooth transitions between steps;
- makes use of appropriate writing strategies, such as creating a visual hierarchy and using white space and graphics as appropriate;
- includes relevant information;
- excludes extraneous information;
- anticipates problems, mistakes, and misunderstandings that might arise for the reader.

A persuasive essay, in which the writer:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- develops a controlling idea that makes a clear and knowledgeable judgment;
- creates an organizing structure that is appropriate to the needs, values, and interests of a specified audience, and arranges details, reasons, examples, and anecdotes effectively and persuasively;
- includes appropriate information and arguments and excludes information and arguments that are irrelevant;
- anticipates and addresses reader concerns and counter arguments;
- supports arguments with detailed evidence, citing sources of information as appropriate;
- uses a range of strategies to elaborate and persuade, such as definitions, descriptions, illustrations, examples from evidence, and anecdotes.

A reflective essay, in which the writer:

- engages the reader by establishing a context, creating a persona, and otherwise developing reader interest;
- analyzes a condition or situation of significance;
- develops a commonplace, concrete occasion as the basis for the reflection, e.g., personal observation or experience;
- creates an organizing structure appropriate to purpose and audience;
- uses a variety of writing strategies, such as concrete details, comparing and contrasting, naming, describing, creating a scenario.

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3. Speaking, Listening, and Viewing

APPENDIX 1

ELEMENTARY SCHOOL

The student accesses and exchanges information; that is, the student:

- asks appropriate questions;
- responds to the questions of others;
- paraphrases and summarizes to increase understanding;
- listens responsively to others' points of view;
- uses language which is simple and appropriate for communicating;
- speaks audibly;
- makes appropriate eye contact;
- respects turn taking of other speakers;
- uses language and gestures expressively and persuasively;
- shows awareness of an audience by adjusting to its reaction.

The student responds to oral presentations; that is, the student:

- asks appropriate questions;
- paraphrases and summarizes to increase understanding;
- speaks audibly;
- uses language and gestures expressively and persuasively.

The student makes informed judgments about television, radio, and film productions; that is, the student:

- articulates reasoned judgments for selecting particular television and radio productions and rejecting others;
- recounts the story elements of television, radio, and film productions;
- identifies the intended messages of advertisements, entertainment programs, and news programs.

MIDDLE SCHOOL

The student accesses and exchanges information; that is, the student:

- asks appropriate questions;
- responds to the questions of others;
- paraphrases and summarizes to increase understanding;
- listens responsively to others' points of view;
- uses language which is simple and appropriate for communicating;
- speaks audibly;
- makes appropriate eye contact;
- respects turn taking of other speakers;
- uses language and gestures expressively and persuasively;
- shows awareness of an audience by adjusting to its reaction.

The student responds to oral presentations; that is, the student:

- asks appropriate questions;
- paraphrases and summarizes to increase understanding;
- speaks audibly;
- uses language and gestures expressively and persuasively.

The student makes informed judgments about television, radio, and film productions; that is, the student:

- articulates reasoned judgments for selecting particular television and radio productions and rejecting others;
- recounts the story elements of television, radio, and film productions;
- identifies the intended messages of advertisements, entertainment programs, and news programs;
- identifies common persuasive techniques used in advertising;
- describes ways used to portray and comment on the general culture.

HIGH SCHOOL

The student accesses and exchanges information; that is, the student:

- asks appropriate questions;
- responds to the questions of others;
- paraphrases and summarizes to increase understanding;
- listens responsively to others' points of view;
- uses language which is simple and appropriate for communicating;
- speaks audibly;
- makes appropriate eye contact;
- respects turn taking of other speakers;
- uses language and gestures expressively and persuasively;
- shows awareness of an audience by adjusting to its reaction.

The student responds to oral presentations; that is, the student:

- asks appropriate questions;
- paraphrases and summarizes to increase understanding;
- speaks audibly;
- uses language and gestures expressively and persuasively.

The student makes informed judgments about television, radio, and film productions; that is, the student:

- articulates reasoned judgments for selecting particular television and radio programs and rejecting others;
- recounts the story elements of television, radio, and film productions;
- identifies the intended messages of advertisements, entertainment programs, and news programs;
- identifies the common persuasive techniques used in advertising;
- describes ways used to portray and comment on the general culture;
- demonstrates an understanding of media stereotyping and other socially significant portrayals;
- understands the effects of media production techniques on viewers' perceptions, including the use of music, camera angles, fade-outs.

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4. Conventions, Grammar, and Usage of the English Language

APPENDIX 1

ELEMENTARY SCHOOL

The student regularly uses, with some teacher assistance, appropriate conventions of the English language, including:

- spelling;
- sentence construction;
- paragraph structure;
- punctuation;
- grammar;
- usage.

The student analyzes and revises written work, as appropriate, relative to audiences and purposes by:

- adding or deleting details;
- adding or deleting explanations;
- clarifying difficult passages;
- rearranging words, sentences, and paragraphs to improve or clarify meaning;
- sharpening the focus;
- reconsidering the organizational structure.

MIDDLE SCHOOL

The student independently uses appropriate conventions of the English language, including:

- spelling;
- sentence construction;
- paragraph structure;
- punctuation;
- grammar;
- usage.

The student analyzes and revises written work, as appropriate, relative to audiences and purposes by:

- adding or deleting details;
- adding or deleting explanations;
- clarifying difficult passages;
- rearranging words, sentences, and paragraphs to improve or clarify meaning;
- sharpening the focus;
- reconsidering the organizational structure.

HIGH SCHOOL

The student independently and habitually uses the appropriate conventions of the English language, including:

- spelling;
- sentence construction;
- paragraph structure;
- punctuation;
- grammar;
- usage.

The student analyzes and revises written work, as appropriate, relative to audiences and purposes by:

- adding or deleting details;
- adding or deleting explanations;
- clarifying difficult passages;
- rearranging words, sentences, and paragraphs to improve or clarify meaning;
- sharpening the focus;
- reconsidering the organizational structure.

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5. Literature

APPENDIX 1

ELEMENTARY SCHOOL

The student responds to fiction, non-fiction, poetry, and drama using interpretive, critical, and evaluative processes; that is, the student does one or more of the following in oral and written presentations:

- examines the reasons for a character's actions, taking into account the situation and basic motivation of the character;
- identifies recurring themes across works;
- identifies stereotypical characters as opposed to fully developed characters;
- critiques the degree to which a plot is contrived or realistic;
- makes inferences and draws conclusions about context, events, characters, and setting;
- analyzes the impact of authors' decisions regarding word choice and content;
- considers the function of point of view or persona;
- considers the differences among genres;
- evaluates literary merit.

The student writes works in specific genres that incorporate appropriate literary features.

MIDDLE SCHOOL

The student responds to fiction, non-fiction, poetry, and drama using interpretive, critical, and evaluative processes; that is, the student does one or more of the following in oral and written presentations:

- analyzes the reasons for a character's actions, taking into account the situation and basic motivation of the character;
- identifies recurring themes across works;
- identifies stereotypical characters as opposed to fully developed characters;
- makes inferences and draws conclusions about context, events, characters, setting, and theme;
- identifies the effect of literary devices such as figurative language, allusion, diction, dialogue, and description;
- interprets the impact of authors' decisions regarding word choice, content, and literary elements;
- identifies the characteristics of literary forms and genres;
- evaluates literary merit;
- identifies the effect of point of view.

The student demonstrates proficiency in at least one literary genre.

HIGH SCHOOL

The student responds to fiction, non-fiction, poetry, and drama using interpretive, critical, and evaluative processes; that is, the student does one or more of the following in oral and written presentations:

- makes inferences and draws conclusions about content, events, characters, setting, theme, and style;
- interprets the effect of literary devices, such as figurative language, allusion, diction, dialogue, description, symbolism;
- evaluates the impact of authors' decisions regarding word choice, style, content, and literary elements;
- analyzes the characteristics of literary forms and genres;
- evaluates literary merit;
- explains the effect of point of view;
- makes thematic connections among literary texts, public discourse, and media;
- interprets ambiguities, subtleties, contradictions, ironies, and nuances;
- demonstrates how literary works reflect the period which shaped them.

The student demonstrates proficiency in at least one literary genre.

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1. Arithmetic and Number Concepts/ Number and Operation Concepts

APPENDIX 2

The elementary school standards are set at a level of performance approximately equivalent to the end of fourth grade. The middle school standards are set at a level of performance approximately equivalent to the end of eighth grade. The high school standards are set at a level of performance approximately equivalent to the end of tenth grade. It is expected that some students might achieve these levels earlier and others later than these grades.

ELEMENTARY SCHOOL

The student:

- adds, subtracts, multiplies, and divides whole numbers, with and without calculators; that is, the student:
  - adds, i.e., joins things together, increases;
  - subtracts, i.e., takes away, compares, finds the difference;
  - multiplies, i.e., uses repeated addition, counts by multiples, combines things that come in groups, makes arrays, uses area models, computes simple scales, uses simple rates;
  - divides, i.e., puts things into groups, shares equally; calculates simple rates;
  - analyzes problem situations and contexts in order to figure out when to add, subtract, multiply, or divide;
  - solves arithmetic problems by relating addition, subtraction, multiplication and division to one another;
  - computes answers mentally, e.g., 27 + 45, 30 x 4;
  - uses simple concepts of negative numbers, e.g., on a number line, in counting, in temperature, "owing";
- demonstrates understanding of the base ten place value system and uses this knowledge to solve arithmetic tasks; that is, the student:
  - counts 1, 10, 100 or 1,000 more than or less than, e.g., one less than 100,000, 10 more than 380, 1,000 more than 23,000, 100 less than 9,000, during arithmetic activities and problem solving;
- uses knowledge about ones, tens, hundreds and thousands to figure out answers to multiplication and division tasks, e.g. 36 x 10, 18 x 100, 7 x 1,000, 4,000 ÷ 4, during arithmetic activities and problem solving;
- estimates, approximates, rounds off, or uses exact numbers, as appropriate, in calculations;
- describes and compares quantities by using simple fractions; that is, the student:
  - finds simple parts of wholes;
  - recognizes simple fractions as instructions to divide, e.g., $\frac{1}{4}$ of something is the same as dividing something by 4;
  - recognizes the place of fractions on number lines, e.g., in measurement;
  - uses drawings, diagrams, or models to show what the numerator and denominator mean, including when adding like fractions, e.g., $\frac{1}{8} + \frac{5}{8}$;
  - uses beginning proportional reasoning and simple ratios, e.g., "about half of the people";
- describes and compares quantities by using decimals; that is, the student:
  - adds, subtracts, multiplies, and divides money amounts;
  - recognizes that decimals are another way of writing fractions, e.g., $0.3 = \frac{3}{10}$;
  - recognizes relationships among simple fractions, decimals, and percents, e.g., that $\frac{1}{2}$ is the same as 0.5, and $\frac{1}{2}$ is the same as 50%;
- describes and compares quantities by using whole numbers up to 1,000,000; that is, the student:
  - connects ideas of quantities to the real world, e.g., how many people fit in a baseball stadium; how far away is a kilometer in your city;
  - finds, identifies, and sorts numbers by their properties, e.g., odd, even; and for two-digit numbers, prime, square, and composite.

MIDDLE SCHOOL

The student:

- consistently and accurately adds, subtracts, multiplies, and divides rational numbers; raises rational numbers to whole number powers;
- understands the inverse relationships between addition and subtraction, multiplication and division, and exponentiation and root-extraction; and uses the inverse operation to determine unknown quantities in equations;
- consistently and accurately computes with, applies, and converts the different kinds and forms of rational numbers, i.e., integers (both whole numbers and negative integers) and other positive and negative rationals, written as decimals, as percents, or as proper, improper, or mixed fractions; irrational numbers, i.e., those that cannot be written as a ratio of two integers, are not required but are suitable for introduction, especially since the student should be familiar with the irrational number π;
- is familiar with characteristics of operations and numbers, e.g., divisibility, prime factorization, and with properties of rational numbers, e.g., commutativity and associativity, short of formal statements;
- interprets percent as part of 100 and as a means of comparing quantities of different sizes or changing sizes;
- reasons proportionally to solve problems involving equivalent fractions or equal ratios;
- orders numbers with the > and < relationships and by location on a number line and has a sense of the magnitudes and relative magnitudes of numbers; note that scientific notation is not required.

HIGH SCHOOL

The student:

- uses the properties of addition, subtraction, multiplication, division, exponentiation, and root-extraction in forming and working with algebraic expressions;
- understands and uses unary operations, such as opposite, reciprocal, absolute value, raising to a fixed power, taking a root, and taking a logarithm;
- has facility with the mechanics of binary and unary operations as well as understanding of their typical meaning and uses in applications;
- understands and uses number systems, that is, natural, integer, rational, and real;
- represents numbers in decimal or fraction form and in scientific notation; and graphs numbers on the number line and in the coordinate plane;
- compares numbers of different magnitude using order relations, differences, ratios, proportions, percents, proportional change, and location on the number line;
- uses dimensionless numbers, such as proportions, percents, and multiplicative factors, and numbers with specific units of measure, including length, time, and rate units;
- recognizes and represents basic number patterns.

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2. Geometry and Measurement Concepts

APPENDIX 2

ELEMENTARY SCHOOL

The student:

- works with many types of figures and their properties, including angles (right, obtuse, acute), triangles, squares, rectangles, rhombi, parallelograms, quadrilaterals, polygons, prisms, pyramids, cubes, circles, and spheres;
- identifies, classifies, and names geometric figures by specific shape properties, e.g., symmetry;
- solves problems by showing relationships between and among figures, e.g., using congruence and similarity, and using transformations including flips, slides, and rotations;
- extends and creates geometric patterns using concrete and pictorial models;
- uses basic ways of measuring the size of figures, including length, width, perimeter, and area;
- uses models to reason about the relationship between the perimeter and area of rectangles in simple situations;
- selects and uses appropriate units for measuring quantities such as weight, length, area, volume, and time;
- carries out simple unit conversions, such as between cm and m, and between hours and minutes;
- measures and creates a scale in maps or scale drawings using the idea of constant ratio.

MIDDLE SCHOOL

The student:

- is familiar with assorted two- and three-dimensional objects, including squares, triangles, other polygons, circles, cubes, rectangular prisms, i.e., "boxes," pyramids, spheres, and cylinders;
- identifies similar and congruent shapes and uses transformations in the coordinate plane, i.e., translations, rotations, and reflections;
- understands length, area, and volume (as well as the differences between these measurements) and the corresponding uses of units, square units, and cubic units of measure;
- recognizes similarity and rotational and bilateral symmetry in two- and three-dimensional figures;
- analyzes and generalizes geometric patterns, such as tessellations and sequences of shapes;
- measures angles, weights, capacities, times, and temperatures using appropriate units;
- chooses appropriate units of measure and converts with ease between like units, e.g., inches and miles, within a customary or metric system; note that conversions between customary and metric are not required;
- reasons proportionally in situations with similar figures;
- reasons proportionally with measurements to interpret maps and to make smaller and larger scale drawings;
- models situations geometrically to formulate and solve problems.

HIGH SCHOOL

The student:

- works with many types of figures and their properties, including polygons and circles, cubes and pyramids, and cylinders, cones, and spheres;
- uses relationships between figures involving congruence and similarity; and characterizes such properties in terms of transformations;
- knows, uses, and derives formulas for area, surface area, and volume of many types of figures;
- uses the Pythagorean Theorem in many types of situations and knows how to prove the theorem;
- works with similar triangles and extends the ideas to include definitions and simple uses of the three basic trigonometric functions;
- analyzes figures in terms of the kinds of symmetries they have;
- studies geometric patterns, including sequences of growing shapes and characterizes the pattern in terms of properties of the n^{th} stage;
- works with geometric measures of length, area, surface area, volume, and angle; and non-geometric measures of weight, monetary value, and time;
- uses quotient measures, such as speed and density, relating them to slope and "per unit" amounts; and uses product measures such as person-days;
- understands the structure of standard measurement systems, both SI and customary, including derived units, unit conversions, and dimensional analysis;
- carries out proportional reasoning: in cases involving expansions and contractions, that is, in situations where sizes in the expanded or contracted figure are proportional to the corresponding sizes in the original figure; and in cases involving figures composed of many identical parts, that is, in situations where the size of the whole is proportional to the number of parts;
- solves problems involving scale and change of scale in maps and diagrams;
- represents geometric curves and graphs of functions in standard coordinate systems;
- analyzes geometric figures and proves things about them using deductive methods;
- models situations geometrically to formulate and solve problems.

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3. Function and Algebra Concepts

APPENDIX 2

ELEMENTARY SCHOOL

The student:

- uses linear patterns to solve problems; that is, the student:
  - shows how one quantity determines another in a linear pattern, i.e. describes, extends, and recognizes the linear pattern by its rule, such as, the total number of legs on a given number of horses can be calculated by counting by fours;
  - shows how one quantity determines another quantity in a functional relationship based on a linear pattern, e.g., for the "number of people and total number of eyes," figure out how many eyes 100 people have all together;
- builds iterations of simple non-linear patterns, including multiplicative and squaring patterns, with concrete materials and recognizes that these patterns are not linear;
- shows that an equality relationship between two quantities remains the same as long as the same change is made to both quantities;
- uses letters, boxes, or other symbols to stand for any number, measured quantity, or object in simple situations with concrete materials, i.e., demonstrates understanding and use of a beginning concept of a variable.

MIDDLE SCHOOL

The student:

- discovers, describes, and generalizes patterns, including linear, exponential, and simple quadratic relationships, i.e., those of the form $f(n)=n^2$ or $f(n)=cn^2$, for constant c, including $A=\pi r^2$, and represents them with variables and expressions;
- represents relationships with tables, graphs in the coordinate plane, and verbal or symbolic rules;
- analyzes tables, graphs, and rules to determine functional relationships;
- finds solutions for unknown quantities in linear equations and in simple equations and inequalities.

HIGH SCHOOL

The student:

- models given situations with linear, exponential, or quadratic functions and interprets given functions in terms of situations;
- discovers, describes, generalizes, and uses basic types of functions; that is, linear, exponential, periodic, power, rational, squares and square roots, and cubes and cube roots;
- works with properties and mechanics of functions; that is, evaluation, inverses, slope, local maxima and minima;
- works with many kinds of rate relationships in constant rate situations;
- uses linear (arithmetic) sequences and exponential (geometric) sequences;
- defines and uses variables, parameters, constants, and unknowns in work with both functions and equations;
- solves equations both symbolically and graphically, especially linear, quadratic, and exponential equations; and knows the quadratic formula and its derivation;
- represents functional relationships in formulas, tables, and graphs, and translates among these;
- understands the basic algebraic structure of number systems;
- is familiar with 2 by 2 matrices, their arithmetic, and some of their uses, such as solving systems of equations and representing symmetries and transformations;
- uses equations to represent curves such as lines, circles, ellipses, parabolas, and hyperbolas;
- uses functions to represent patterns.

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4. Statistics and Probability Concepts

APPENDIX 2

ELEMENTARY SCHOOL

The student:

- collects and organizes data to answer a question or test a hypothesis by comparing sets of data;
- displays data in graphs, tables, and charts;
- makes statements and draws simple conclusions based on data; that is, the student:
  - reads for information data in tables, charts, and graphs;
  - compares data in order to make true statements, e.g., "seven plants grew at least 5 cm";
  - identifies and uses the mode necessary for making true statements, e.g., "most people chose red";
  - makes true statements based on a simple concept of "average" or mean, for a small sample size and where the situation is made evident with concrete materials or clear representations;
  - interprets data to determine the reasonableness of statements about the data, e.g., "twice as often," "three times faster";
  - uses data, including statements about the data, to make a simple concluding statement about a situation, e.g., "This kind of plant grows better near sunlight because the seven plants that were near the window grew at least 5 cm";
- gathers data about an entire group or by sampling group members to understand the concept of "sample", e.g., that a large sample leads to more reliable information;
- predicts and finds out why some outcomes are more likely, less likely, or equally likely;
- finds all possible combinations and arrangements within certain constraints involving a limited number of variables.

MIDDLE SCHOOL

The student:

- collects and organizes data and displays data with appropriate tables, charts, and graphs;
- analyzes data with respect to characteristics of frequency and distribution, including mode and range;
- analyzes appropriately central tendencies of data with mean and median;
- makes conclusions and recommendations based on data analysis;
- critiques the conclusions and recommendations of others' statistics;
- considers effects on reliability of sampling procedures and of missing or incorrect information;
- formulates hypotheses to answer a question and uses data to test hypotheses;
- recognizes equally likely outcomes, constructs sample spaces, and determines probabilities of events;
- makes predictions based on experimental or theoretical probabilities;
- predicts the result of a series of trials once the probability for one trial is known.

HIGH SCHOOL

The student:

- collects, organizes, displays, and analyzes single-variable data using frequency distributions, histograms, and summary statistics;
- collects, organizes, displays, and analyzes two-variable data using scatter plots, estimated regression lines, and computer-generated regression lines and correlation coefficients;
- understands the role of assumptions and uncertainty in making inferences;
- critiques conclusions and the use of statistics in public documents;
- uses sampling techniques to draw inferences about large populations;
- explores questions of experimental design, use of control groups, and reliability;
- formulates hypotheses to answer a question and uses data to test hypotheses;
- uses theoretical probability models to arrive at probabilities for chance events;
- uses experimental measures of likelihood based on gathering of data to arrive at relative frequencies for chance events;
- uses simulations to estimate probabilities;
- sets up and works with appropriate sample spaces and applies the addition and multiplication principles appropriately;
- works with the normal distribution in some of its basic uses.

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5. Problem Solving and Mathematical Reasoning

APPENDIX 2

ELEMENTARY SCHOOL

The student solves problems that make significant demands in one or more of these aspects of the solution process: problem formulation, problem implementation, and problem conclusion.

Problem formulation
The student participates in the formulation of problems; that is, given the basic statement of a problem situation, the student:

- makes decisions about the approach, materials, and strategies to use;
- uses previously learned strategies, skills, knowledge, and concepts to make decisions;
- uses strategies, such as using manipulatives or drawing sketches, to model problems;
- does not merely fill in a given chart, use a pre-specified manipulative or go through a predetermined set of steps.

Problem implementation
The student makes the basic choices involved in planning and carrying out a solution; that is, the student:

- makes up and uses a variety of strategies and approaches to solving problems and learns approaches that other people use;
- makes connections among concepts in order to solve problems;
- solves problems in ways that make sense and explains why these ways make sense, e.g., defends the reasoning, explains the solution.

Problem conclusion
The student moves beyond a particular problem by making connections, extensions, and/or generalizations; for example, the student:

- explains a pattern that can be used in similar situations;
- explains how the problem is similar to other problems he or she has solved;
- explains how the mathematics used in the problem is like other concepts in mathematics;
- explains how the problem solution can be applied to other school subjects and in real world situations;
- makes the solution into a general rule that applies to other circumstances.

MIDDLE SCHOOL

The student solves problems that make significant demands in one or more of these aspects of the solution process: problem formulation, problem implementation, and problem conclusion.

Problem formulation
The student:

- formulates and solves a variety of meaningful problems;
- extracts pertinent information from situations and figures out what additional information is needed;
- formulates conjectures and argues, short of formal proof, why they must be or seem true.

Problem implementation
The student:

- uses and invents a variety of approaches and understands and evaluates those of others;
- invokes problem solving strategies, such as illustrating with sense making sketches to clarify situations or organizing information in a table;
- determines, where helpful, how to break a problem into simpler parts;
- solves for unknown or undecided quantities using algebra, graphing, sound reasoning, and other strategies;
- integrates concepts and techniques from different areas of mathematics;
- works effectively in teams when the nature of the task or the allotted time makes this an appropriate strategy;
- makes sensible, reasonable estimates;
- makes justified, logical statements.

Problem conclusion
The student:

- verifies and interprets results with respect to the original problem situation;
- generalizes solutions and strategies to new problem situations.

HIGH SCHOOL

The student solves problems that make significant demands in one or more of these aspects of the solution process: problem formulation, problem implementation, and problem conclusion.

Problem formulation
The student participates in the formulation of problems; in particular, given the basic statement of a problem situation, the student:

- fills out the formulation of a definite problem that is to be solved;
- extracts pertinent information from the situation as a basis for working on the problem;
- asks and answers a series of appropriate questions in pursuit of a solution and does so with minimal "scaffolding" in the form of detailed guiding questions.

Problem implementation
The student makes the basic choices involved in planning and carrying out a solution; in particular, the student:

- chooses and employs effective problem solving strategies in dealing with non-routine and multi-step problems;
- selects appropriate mathematical concepts and techniques from different areas of mathematics and applies them to the solution of the problem;
- applies mathematical concepts to new situations within mathematics and uses mathematics to model real world situations involving basic applications of mathematics in the physical sciences, the social sciences, and business.

Problem conclusion
The student provides closure to the solution process through summary statements and general conclusions; in particular, the student:

- concludes a solution process with a useful summary of results;
- evaluates the degree to which the results obtained represent a good response to the initial problem;
- formulates generalizations of the results obtained;
- carries out extensions of the given problem to related problems.

Mathematical Reasoning
The student not only makes observations and states results but also justifies or proves why the results hold in general; in particular, the student:

- employs forms of mathematical reasoning and proof appropriate to the solution of the problem at hand, including deductive and inductive reasoning, making and testing conjectures, and using counterexamples and indirect proof;
- differentiates clearly between giving examples that support a conjecture and giving a proof of the conjecture.

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6. Mathematical Skills and Tools

APPENDIX 2

ELEMENTARY SCHOOL

The student:

- adds, subtracts, multiplies, and divides whole numbers correctly; that is, the student:
  - knows single digit addition, subtraction, multiplication, and division facts;
  - adds and subtracts numbers with several digits;
  - multiplies and divides numbers with one or two digits;
  - multiplies and divides three digit numbers by one digit numbers;
- estimates numerically and spatially;
- measures length, area, perimeter, circumference, diameter, height, weight, and volume accurately in both the customary and metric systems;
- computes time and money; that is the student:
  - computes lengths of time in hours and minutes;
  - calculates money amounts in dollars and cents;
- refers to geometric shapes and terms correctly with concrete objects, including triangle, square, rectangle, rhombus, parallelogram, quadrilateral, polygon, polyhedron, angle (right, acute, obtuse), side, edge, face, cube, vertex, point, line, perimeter, area, volume, circle, diameter, circumference, sphere, prism, and pyramid;
- uses +, -, x, ÷, /, $\overline{}$, $, ¢, %, and . (decimal point) correctly in number sentences and expressions;
- reads, creates, and represents data on charts, tables, diagrams, bar graphs, simple circle graphs, and coordinate graphs;
- uses recall, mental computations, pencil and paper, measuring devices, mathematics texts, manipulatives, calculators, computers, and advice from peers, as appropriate, to achieve solutions; that is, the student:
  uses measuring devices, graded appropriately for given situations, such as rulers (customary to the $\frac{1}{16}$ inch; metric to the millimeter), protractors, compasses, graph paper (customary to the inch or half-inch; metric to the centimeter), measuring cups (customary to the ounce; metric to the milliliter), scales (customary to the pound or ounce; metric to the kilogram or gram);
  interprets long decimals that result from dividing on calculators, by rounding to the nearest appropriate place (whole number, tenth or hundredth).

MIDDLE SCHOOL

The student:

- computes accurately with arithmetic operations on rational numbers;
- knows and uses the correct order of operations for arithmetic computations;
- estimates numerically and spatially;
- measures length, area, volume, weight, time, and temperature accurately;
- refers to geometric shapes and terms correctly;
- uses equations, formulas, and simple algebraic notation appropriately;
- organizes data on charts and graphs, including scatter plots, bar, line, and circle graphs, and Venn diagrams;
- uses recall, mental computations, pencil and paper, measuring devices, mathematics texts, manipulatives, calculators, computers, and advice from peers, as appropriate, to achieve solutions.

HIGH SCHOOL

The student:

- computes accurately using arithmetic and algebraic operations on whole and rational numbers, using both pencil and paper and technology;
- makes reasonable estimates in appropriate units of quantities met in applications;
- evaluates and analyzes functions of many kinds, using both pencil and paper and technology;
- uses basic geometric terminology accurately and deduces information about basic geometric figures in solving problems;
- makes and uses rough sketches, schematic diagrams, or precise scale diagrams to enhance a solution;
- plots points on the number line, in the plane, and in space;
- creates and interprets graphs of many kinds, such as circle graphs, function graphs, scatter plots, regression lines, and histograms;
- sets up and solves equations symbolically (when possible) and graphically;
- uses technology to create graphs or spreadsheets that contribute to the understanding of a problem;
- knows how to write a simple computer program to carry out computations to be repeated many times;
- knows standard methods to solve basic problems and uses these methods in approaching more complex problems;
- carries out numerical calculations and symbol manipulations effectively, using mental computations, pencil and paper, or technological aids, as appropriate.

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APPENDIX 2

ELEMENTARY SCHOOL

The student:

- uses appropriate mathematical terms, vocabulary and language, based on prior conceptual work;
- shows ideas in a variety of ways, including words, numbers, symbols, pictures, charts, graphs, tables, diagrams, and models;
- explains clearly and logically solutions to problems, and supports solutions with evidence, in both oral and written form;
- considers purpose and audience when communicating;
- comprehends mathematics from reading assignments and from other sources.

MIDDLE SCHOOL

The student:

- uses mathematical language and representations with appropriate accuracy, including numerical tables and equations, simple algebraic equations and formulas, charts, graphs, and diagrams;
- organizes work, explains facets of a solution orally and in writing, labels drawings, and uses other techniques to make meaning clear to the audience;
- uses mathematical language to make complex situations easier to understand;
- exhibits developing reasoning abilities by justifying statements and defending work;
- shows understanding of concepts by explaining ideas not only to teachers and assessors but to fellow students or younger children;
- comprehends mathematics from reading assignments and from other sources.

HIGH SCHOOL

The student:

- is familiar with basic mathematical vocabulary and terminology, standard notation and use of symbols, common conventions for graphing, and general features of effective mathematical communication styles;
- uses mathematical representations with appropriate accuracy, including numerical tables, formulas, functions, algebraic equations, charts, graphs, and diagrams;
- presents mathematical procedures and results clearly, systematically, succinctly, and correctly;
- communicates logical arguments clearly, showing why a result makes sense and why the reasoning is valid;
- describes and discusses mathematical ideas effectively both orally and in writing;
- explains mathematical concepts or ideas clearly to peers or others who may be having difficulty with them;
- reads mathematical texts and other writing about mathematics with understanding.

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APPENDIX 2

ELEMENTARY SCHOOL

The student conducts at least one large scale project each year drawn from the following kinds and, over the course of elementary school, projects drawn from at least three of the kinds.

A single project may draw on more than one kind.

Data study, in which the student:

- develops a question and a hypothesis in a situation where data could help make a decision or recommendation;
- decides on a group or groups to be sampled and makes predictions of the results, with specific percents, fractions, or numbers;
- collects, represents, and displays data in order to help make the decision or recommendation; compares the results with the predictions;
- writes a report that includes recommendations supported by diagrams, charts, and graphs; acknowledges assistance received from parents, peers, and teachers.

Science study, in which the student:

- decides on a specific science question to study and identifies the mathematics that will be used, e.g., measurement;
- develops a prediction (a hypothesis) and develops procedures to test the hypothesis;
- collects and records data; represents and displays data; compares results to predictions;
- writes a report that compares the results with the hypothesis; supports the results with diagrams, charts, and graphs; acknowledges assistance received from parents, peers, and teachers.

Design of a physical structure, in which the student:

- decides on a structure to design, the size and budget constraints, and the scale of design;
- makes a first draft of the design, and revises and improves the design in response to input from peers and teachers;
- makes a final draft and report of the design, drawn and written so that another person could make the structure; acknowledges assistance received from parents, peers, and teachers.

Management and planning, in which the student:

- decides on what to manage or plan and what goal will be used to see if the plan worked;
- identifies unexpected events that could disrupt the plan and further plans for such contingencies;
- identifies resources needed, e.g., materials, money, time, space, and other people;
- writes down a detailed plan; revises and improves the plan in response to feedback from peers and teachers;
- carries out the plan (optional);
- writes up a report on the plan, that includes resources, budget, and schedule; acknowledges assistance received from parents, peers, and teachers.

Pure mathematics investigation, in which the student:

- decides on the area of mathematics to investigate, e.g., numbers, shapes, patterns;
- describes a question or concept that he or she will seek to better understand;
- decides on representations that will be used, e.g., numbers, symbols, diagrams, shapes, or physical models;
- carries out the investigation;
- writes up a report, including generalizations if there were any; acknowledges assistance received from parents, peers, and teachers.

Other kinds of projects involving putting mathematics to work, chosen by the student or teacher, in which the student:

- identifies, with the teacher, and writes down a clear purpose for the project, what will be accomplished, and how the project involves putting mathematics to work;
- develops a question and a plan; writes a detailed description of how the project was carried out, including mathematical analysis of the results; and a report that includes acknowledgment of assistance received from parents, peers, and teachers.

MIDDLE SCHOOL

The student conducts at least one large scale investigation or project each year drawn from the following kinds and, over the course of middle school, investigations or projects drawn from at least three of the kinds.

A single investigation or project may draw on more than one kind.

Data study based on civic, economic, or social issues, in which the student:

- selects an issue to investigate;
- makes a hypothesis on an expected finding;
- gathers data;
- analyzes the data using concepts from Standard 4, e.g., considering mean and median, and the frequency and distribution of the data;
- shows how the study's results compare with the hypothesis;
- uses pertinent statistics to summarize;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the findings.

Mathematical model of physical phenomena, often used in science studies, in which the student:

- carries out a study of a physical system using a mathematical representation of the structure;
- uses understanding from Standard 3, particularly with respect to the determination of the function governing behavior in the model;
- generalizes about the structure with a rule, i.e., a function, that clearly applies to the phenomenon and goes beyond statistical analysis of a pattern of numbers generated by the situation;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the findings.

Design of a physical structure, in which the student:

- generates a plan to build something of value, not necessarily monetary value;
- uses mathematics from Standard 2 to make the design realistic or appropriate, e.g., areas and volumes in general and of specific geometric shapes;
- summarizes the important features of the structure;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the findings.

Management and planning, in which the student:

- determines the needs, e.g., cost, supply, scheduling, of the event to be managed or planned;
- notes any constraints that will affect the plan;
- determines a plan;
- uses concepts from any of Standards 1 to 4, depending on the nature of the project;
- considers the possibility of a more efficient solution;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the plan.

Pure mathematics investigation, in which the student:

- extends or "plays with," as with mathematical puzzles, some mathematical feature, e.g., properties and patterns in numbers;
- uses concepts from any of Standards 1 to 4, e.g., an investigation of Pascal's triangle would have roots in Standard 1 but could tie in concepts from geometry, algebra, and probability; investigations of derivations of geometric formulas would be rooted in Standard 2 but could require algebra;
- determines and expresses generalizations from patterns;
- makes conjectures on apparent properties and argues, short of formal proof, why they seem true;
- prepares a presentation or report that includes the question investigated, a detailed description of how the project was carried out, and an explanation of the findings.

Other kinds of projects putting mathematics to work chosen by student or teacher.

HIGH SCHOOL

The student conducts at least one large scale investigation or project each year drawn from the following kinds and, over the course of high school, investigations or projects drawn from at least three of the kinds.

A single investigation or project may draw on more than one kind.

Data study, in which the student:

- carries out a study of data relevant to current civic, economic, scientific, health, or social issues;
- uses methods of statistical inference to generalize from the data;
- prepares a report that explains the purpose of the project, the organizational plan, and conclusions, and uses an appropriate balance of different ways of presenting information.

Mathematical model of a physical system or phenomenon, in which the student:

- carries out a study of a physical system or phenomenon by constructing a mathematical model based on functions to make generalizations about the structure of the system;
- uses structural analysis (a direct analysis of the structure of the system) rather than numerical or statistical analysis (an analysis of data about the system);
- prepares a report that explains the purpose of the project, the organizational plan, and conclusions, and uses an appropriate balance of different ways of presenting information.

Design of a physical structure, in which the student:

- creates a design for a physical structure;
- uses general mathematical ideas and techniques in discussing specifications for building the structure;
- prepares a report that explains the purpose of the project, the organizational plan, and conclusions, and uses an appropriate balance of different ways of presenting information.

Management and planning analysis, in which the student:

- carries out a study of a business or public policy situation involving issues such as optimization, cost-benefit projections, and risks;
- uses decision rules and strategies both to analyze options and balance trade-offs; and brings in mathematical ideas that serve to generalize the analysis across different conditions;
- prepares a report that explains the purpose of the project, the organizational plan, and conclusions, and uses an appropriate balance of different ways of presenting information.

Pure mathematics investigation, in which the student:

- carries out a mathematical investigation of a phenomenon or concept in pure mathematics;
- uses methods of mathematical reasoning and justification to make generalizations about the phenomenon;
- prepares a report that explains the purpose of the project, the organizational plan, and conclusions, and uses an appropriate balance of different ways of presenting information.

History of a mathematical idea, in which the student:

- carries out a historical study tracing the development of a mathematical concept and the people who contributed to it;
- prepares a report that explains the purpose of the project, the organizational plan, and conclusions, and uses an appropriate balance of different ways of presenting information.

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1. Physical Sciences Concepts

The Grade Levels Compared: *Science*

APPENDIX 3

The elementary school standards are set at a level of performance approximately equivalent to the end of fourth grade. The middle school standards are set at a level of performance approximately equivalent to the end of eighth grade. The high school standards are set at a level of performance approximately equivalent to the end of tenth grade. It is expected that some students might achieve these levels earlier and others later than these grades.

The Science standards are founded upon both the American Association for the Advancement of Science's Project 2061 *Benchmarks for Scientific Literacy* and the National Research Council's *National Science Education Standards draft*. The Science standards will also take into account the work of the National Science Teachers Association as they revise their *Scope, Sequence, and Coordination Content Core* and develop assessment tasks.

These documents, each of which runs to several hundred pages, contain detail that amplifies the meaning of the terms used here.

ELEMENTARY SCHOOL

The student understands:

- the observable properties of objects and materials;
- motions of objects, in particular, push and pull, sound;
- heat, light, electricity, and magnetism.

MIDDLE SCHOOL

The student understands:

- characteristic properties of matter, in particular, density; conservation of matter;
- motions and forces, and the relationships among them, for example, effects of unbalanced forces;
- transfer and transformations of energy, including forms and conversion.

HIGH SCHOOL

The student understands:

- structure and properties of matter, in particular, composition of atoms, bonding, elements and compounds;
- chemical reactions, including concentration, pressure, temperature, catalysts;
- forces and motions, including net force, gravitational, electrical, magnetic;
- conservation of energy, in particular, transfer, heat;
- interactions of energy and matter, especially waves and wavelengths.

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2. Life Sciences Concepts

ELEMENTARY SCHOOL

The student understands:

- characteristics of organisms; that is, needs, environments that meet them; structures, especially senses; variation and behaviors, inherited and learned;
- life cycles, including birth, development, reproduction;
- organisms and environments, in particular, food chains, populations, effects on the environment;
- change over time, including fossil evidence.

MIDDLE SCHOOL

The student understands:

- structure and function of cells, tissues, and organs;
- reproduction and heredity, including genes, traits, and learning;
- regulation and behavior, especially the roles of senses and hormones;
- population and ecosystems, including food webs, resources, and energy;
- evolution, in particular, species, diversity and adaptation, variation, extinction.

HIGH SCHOOL

The student understands:

- cells, including structure and function, uses of energy and food;
- molecular basis of heredity, including DNA, chromosomes, mutations;
- behavior of organisms, especially hormones, nervous system, evolution;
- interdependence of organisms, especially flow of energy, cooperation and competition, environmental constraints;
- biological evolution, in particular, natural selection; and adaptation, including species, variation, extinction.

APPENDIX 3

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3. Earth and Space Sciences Concepts

APPENDIX 3

ELEMENTARY SCHOOL

The student understands:

- properties and uses of Earth materials, including rocks, soils, water, and gases;
- patterns, cycles, seasons, time, weather, and Earth motion;
- change over time, for example, erosion.

MIDDLE SCHOOL

The student understands:

- Earth's systems, including crustal plates and land forms; rock cycle, water cycle; weather and oceans;
- Earth's history, especially change over time, erosion, movement of plates, fossil evidence;
- Earth in the Solar System, including day, year; sun, planet; gravity, energy;
- natural resource management.

HIGH SCHOOL

The student understands:

- Earth's systems, including the Sun, radioactive decay, gravitational energy; weather and climate;
- origin and evolution of the Earth system, in particular, estimating geologic time, age of life forms;
- forces that shape the Earth; that is, processes and observable results;
- natural resource management.

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4. Scientific Connections and Applications

ELEMENTARY SCHOOL

The student understands:

- big ideas and unifying concepts, for example, order, models, form, change, cause and effect;
- the designed world, in particular, agriculture and technology;
- health, especially nutrition, germs, toxic substances, safety;
- science as a human endeavor.

MIDDLE SCHOOL

The student understands:

- big ideas and unifying concepts; for example, order and organization, models, systems, evolution and equilibrium, form and function, cause and effect, constancy and change;
- technology, including tradeoffs, constraints, feedback, risk;
- the designed world, including agriculture and industry;
- health, especially nutrition, exercise, and disease; toxic substances; safety; relationships with the environment;
- historical and contemporary impact of science.

HIGH SCHOOL

The student understands:

- big ideas and unifying concepts; for example, order and organization, models, systems, evolution and equilibrium, form and function, cause and effect, constancy and change;
- technology, including cost/benefit, constraints, feedback, risk;
- the designed world, including agriculture and industry;
- health, especially nutrition, exercise, and disease; toxic substances; safety; relationship to environment;
- historical and contemporary impact of science.

APPENDIX 3

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5. Scientific Thinking

APPENDIX 3

ELEMENTARY SCHOOL

The student uses scientific reasoning strategies, scientific knowledge, and common sense to formulate questions about, understand, and explain a wide range of phenomena; that is, the student:

- asks questions about objects, organisms, and events in the world;
- seeks information from reliable sources, including scientific knowledge, observation, and trying things out;
- uses evidence to construct an explanation; recognizes a fair test;
- recognizes others' points of view; checks his or her own and others' explanations against experiences, observations, and knowledge;
- identifies problems, proposes and implements solutions, evaluates products or designs;
- works individually and in teams to collect and share information and ideas.

MIDDLE SCHOOL

The student uses scientific reasoning strategies, scientific knowledge, and common sense to formulate questions about, understand, and explain a wide range of phenomena; that is, the student:

- frames questions so that causes and effects can be distinguished; identifies variables that influence a situation and can be controlled;
- uses concepts from Standards 1 to 4 to explain a variety of observations and phenomena;
- uses evidence to develop descriptions, explanations, and models;
- proposes, recognizes, analyzes, considers, and critiques alternative explanations; distinguishes between fact and opinion;
- identifies problems; proposes and implements solutions; evaluates products or designs;
- works individually and in teams to collect and share information and ideas.

HIGH SCHOOL

The student uses scientific reasoning strategies, scientific knowledge, and common sense to formulate questions about, understand, and explain a wide range of phenomena; that is, the student:

- frames questions so that causes and effects can be distinguished; identifies variables that influence a situation and can be controlled;
- formulates and revises explanations and models based on evidence and logical argument, preserving significant information;
- proposes, recognizes, analyzes, considers, and critiques alternative explanations; distinguishes between fact and opinion;
- identifies problems or design opportunities; proposes designs and chooses among alternatives; implements a solution and evaluates its consequences;
- works individually and in teams to collect and share information and ideas.

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6. Scientific Tools and Technologies

ELEMENTARY SCHOOL

The student uses tools and technologies to collect and analyze data; that is, the student:

- uses simple technology and tools to gather data and extend the senses, for example, rulers, balances, thermometers, watches, magnifiers, and microscopes;
- collects and analyzes data, using concepts and skills in Mathematics Standard 4, Statistics and Probability Concepts;
- acquires information from print and non-print sources.

MIDDLE SCHOOL

The student uses tools and technologies to collect and analyze data; that is, the student:

- uses a variety of traditional and electronic tools to directly, indirectly, and remotely observe and measure objects, organisms, and phenomena;
- records and stores data in a variety of formats, including databases, audiotapes, and videotapes;
- analyzes data, while alert to observer and sample biases, using concepts and skills from Mathematics Standard 4, Statistics and Probability Concepts;
- acquires information from print, electronic, and visual sources, including computer databases.

HIGH SCHOOL

The student uses tools and technologies to collect and analyze data; that is, the student:

- uses a variety of traditional and electronic tools to directly, indirectly, and remotely observe and measure objects, organisms, and phenomena, being alert to accuracy and precision;
- records and stores data in a variety of formats, including databases, audiotapes, and videotapes;
- analyzes data, taking steps to limit observer and sample biases, using concepts and skills from Mathematics Standard 4, Statistics and Probability Concepts;
- acquires information from print, electronic, and visual sources, including the Internet.

APPENDIX 3

The General Accounting Office recently reported that more than half of 10,000 schools surveyed lacked modems and phone lines, that only 35% of schools and 3% of classrooms currently have access to the Internet. We know this is an equity issue—that far more than 3% of the homes in the United States have access to the Internet and that schools must make sure that students' access to information and ideas does not depend on what they get at home. Standard 6, Scientific Tools and Technologies, includes using telecommunications to acquire and share information. New Standards' partners have pledged to create the learning environments where students can develop the knowledge and skills delineated here.

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7. Scientific Communication

The Grade Levels Compared: *Science*

APPENDIX 3

ELEMENTARY SCHOOL

The student communicates clearly and effectively about the natural world; that is,the student:

- represents data and results in more than one way, for example, numbers, drawings, words, tables;
- uses facts to support conclusions;
- critiques written and oral explanations;
- writes instructions that others can follow;
- communicates in a form suited to the purpose and the audience; uses data to resolve disagreements.

MIDDLE SCHOOL

The student communicates clearly and effectively about the natural world; that is, the student:

- represents data and results in multiple ways; for example, numbers and statistics; drawings, diagrams, and pictures; sentences; charts and tables; models;
- argues from evidence, including his or her own data and the data of others;
- critiques published materials;
- explains a scientific concept or procedure to other students;
- communicates in a form suited to the purpose and the audience; responds to critical comments with data.

HIGH SCHOOL

The student communicates clearly and effectively about the natural world; that is, the student:

- represents data and results in multiple ways; for example, numbers and statistics; drawings, diagrams, and pictures; sentences; charts and tables; models; and uses the most effective way to make the point;
- summarizes varied sources of evidence, including his or her own data and published reports;
- critiques published materials, including popular and academic sources;
- explains a scientific concept or procedure to other students;
- communicates in a form suited to the purpose and the audience; responds to critical comments with data and reasoning.

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8. Scientific Investigation

ELEMENTARY SCHOOL

The student completes projects drawn from the following kinds of investigation, including at least one full investigation each year and, over the course of elementary school, investigations representing all four kinds.

- Experiment; that is, conducting a fair test;
- Systematic observation;
- Design;
- Research using print and electronic (that is, video or computer) information.

A single project may draw on more than one type of investigation.

A full investigation includes:

- questions that can be studied using the resources available;
- procedures that are safe, humane, and ethical; respect privacy and property rights;
- data that have been collected and recorded (see also Science Standard 6) in ways that others can verify, and analyzed using skills expected at this grade level (see also Mathematics Standard 4);
- data and results that have been represented (see also Science Standard 7) in ways that fit the context;
- recommendations, decisions, and conclusions based on evidence;
- acknowledgment of references and contributions of others;
- results that are communicated appropriately to audiences;
- reflection and defense of conclusions and recommendations from other sources and peer review.

MIDDLE SCHOOL

The student completes projects drawn from the following kinds of investigation, including at least one full investigation each year and, over the course of middle school, investigations representing all four kinds.

- Controlled experiment;
- Fieldwork;
- Design;
- Secondary research; that is, use of others' data.

A single project may draw on more than one type of investigation.

A full investigation includes:

- questions that can be studied using the resources available;
- procedures that are safe, humane, and ethical; respect privacy and property rights;
- data that have been collected and recorded (see also Science Standard 6) in ways that others can verify, and analyzed using skills expected at this grade level (see also Mathematics Standard 4);
- data and results that have been represented (see also Science Standard 7) in ways that fit the context;
- recommendations, decisions, and conclusions based on evidence;
- acknowledgment of references and contributions of others;
- results that are communicated appropriately to audiences;
- reflection and defense of conclusions and recommendations from other sources and peer review.

HIGH SCHOOL

The student completes projects drawn from the following kinds of investigation, including at least one full investigation each year and, over the course of high school, investigations representing all four kinds.

- Controlled experiment;
- Fieldwork;
- Design;
- Secondary research; that is, use of others' data.

A single project may draw on more than one type of investigation.

A full investigation includes:

- questions that can be studied using the resources available;
- procedures that are safe, humane, and ethical; respect privacy and property rights;
- data that have been collected and recorded (see also Science Standard 6) in ways that others can verify, and analyzed using skills expected at this grade level (see also Mathematics Standard 4);
- data and results that have been represented (see also Science Standard 7) in ways that fit the context;
- recommendations, decisions, and conclusions based on evidence;
- acknowledgment of references and contributions of others;
- results that are communicated appropriately to audiences;
- reflection and defense of conclusions and recommendations from other sources and peer review.

APPENDIX 3

Best practice in Science has always included extensive inquiry and investigation, but it is frequently given less emphasis at the elementary and middle school levels. There are many opportunities to learn Science outside of school, including Scouts, Boys and Girls Clubs, 4-H and Future Farmers of America. The work done in these venues can and should be used to provide evidence of meeting the standards.

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1. Problem Solving

The Grade Levels Compared: *Applied Learning*

APPENDIX 4

The elementary school standards are set at a level of performance approximately equivalent to the end of fourth grade. The middle school standards are set at a level of performance approximately equivalent to the end of eighth grade. The high school standards are set at a level of performance approximately equivalent to the end of tenth grade. It is expected that some students might achieve these levels earlier and others later than these grades.

The standards for Applied Learning have been revised substantially since the last published draft of these Performance Standards. Contact New Standards for information about the content framework that has provided the foundation for the Applied Learning standards.

ELEMENTARY SCHOOL

The student completes projects involving at least two of the following kinds of problem solving each year and, over the course of elementary school, projects involving all three kinds of problem solving.

- Designing: identifying needs that could be met by new products, services, or systems; and creating solutions for meeting them;
- Planning and Organizing: taking responsibility for all aspects of planning and organizing an event or activity from concept to completion, making good use of the resources of people, time, money, and materials and facilities;
- Improving a System: developing an understanding of the way systems of people, machines, and processes work; troubleshooting problems in their operation; and devising strategies for improving their effectiveness.

A single project may involve more than one kind of problem solving.

Designing

The student designs a product, service, or system to meet an identified need; that is, the student:

- develops ideas for design of the product, service, or system;
- identifies factors affecting choice of the best idea for the design and makes a decision based on those factors;
- selects and uses an appropriate form for presenting the design plan;
- establishes criteria for judging the success of the design;
- plans and carries out the steps of the production process;
- evaluates the quality of the design by considering the criteria for success and by comparison with similar products, services, or systems.

Planning and Organizing

The student plans and organizes an event or activity; that is, the student:

- develops a plan that:
  - includes all the factors and variables that need to be considered;
  - makes sense in terms of the order in which things need to be done;
  - makes sense in terms of the people, time, and resources available to put the plan into action;
  - is described clearly enough for someone else to use it;
- implements the plan;
- evaluates the success of the event or activity, identifying the parts of the plan that worked best and the aspects that could have been improved by better planning and organization, and proposing how the improvements could have been achieved;
- makes recommendations to others who might consider planning and organizing a similar event or activity.

Improving a System

The student troubleshoots problems in the operation of a system in need of repair or devises and tests ways of improving the effectiveness of a system in operation; that is, the student:

- identifies the parts of the system and the way the parts connect with each other;
- identifies parts or connections in the system that have broken down or that could be made to work better;
- devises ways of making the system work again or making it work better;
- checks whether the strategies worked.

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MIDDLE SCHOOL

The student completes projects involving at least two of the following kinds of problem solving each year and, over the course of middle school, projects involving all three kinds of problem solving.

- Designing: identifying needs that could be met by new products, services, or systems; and creating solutions for meeting them;
- Planning and Organizing: taking responsibility for all aspects of planning and organizing an event or activity from concept to completion, making good use of the resources of people, time, money, and materials and facilities;
- Improving a System: developing an understanding of the way systems of people, machines, and processes work; troubleshooting problems in their operation; and devising strategies for improving their effectiveness.

A single project may involve more than one kind of problem solving.

Designing

The student designs a product, service, or system to meet an identified need; that is, the student:

- develops a range of design options;
- selects one design option to pursue and justifies the choice, for example, with reference to functional, aesthetic, social, economic, or environmental considerations;
- identifies, where relevant, the principles on which the decision was based, such as aesthetic, mathematical, scientific;
- uses appropriate conventions to represent the design;
- establishes criteria for judging the success of the design;
- plans and carries out the steps of the production process;
- adjusts the production process as required to achieve specified standards of quality and safety;
- evaluates the quality of the design by considering the criteria for success and by comparison with similar products, services, or systems.

Planning and Organizing

The student plans and organizes an event or activity; that is, the student:

- develops a plan that:
  - reflects research into relevant precedents and regulations;
  - includes all the factors and variables that need to be considered;
  - makes sense in terms of the order in which things need to be done;
  - makes sense in terms of the people, time, and resources available to put the plan into action;
  - is described clearly enough for someone else to use it;
- implements the plan in ways that:
  - reflect established priorities;
  - respond effectively to unforeseen circumstances;
- evaluates the success of the event or activity, identifying the parts of the plan that worked best and the aspects that could have been improved by better planning and organization, and proposing how the improvements could have been achieved;
- makes recommendations to others who might consider planning and organizing a similar event or activity.

Improving a System

The student troubleshoots problems in the operation of a system in need of repair or devises and tests ways of improving the effectiveness of a system in operation; that is, the student:

- describes the management and structure of the system in terms of its logic, sequences, and control;
- identifies the operating principles underlying the system, i.e., mathematical, scientific, organizational;
- analyzes the design and management of the system with reference to its functional, aesthetic, social, commercial, and environmental requirements, as appropriate;
- evaluates the operation of the system;
- devises strategies for putting the system back in operation or improving its performance;
- tests the effectiveness of the strategies employed.

HIGH SCHOOL

The student completes projects involving at least two of the following kinds of problem solving each year and, over the course of high school, projects involving all three kinds of problem solving.

- Designing: identifying needs that could be met by new products, services, or systems, and creating solutions for meeting them;
- Planning and Organizing: taking responsibility for all aspects of planning and organizing an event or activity from concept to completion, making good use of the resources of people, time, money, and materials and facilities;
- Improving a System: developing an understanding of the way systems of people, machines, and processes work; troubleshooting problems in their operation; and devising strategies for improving their effectiveness.

A single project may involve more than one kind of problem solving.

Designing

The student designs a product, service, or system to meet an identified need; that is, the student:

- develops a design proposal that:
  - shows how the ideas have been developed;
  - reflects awareness of similar work done by others and of relevant design standards and regulations;
  - justifies the choices made, for example, with reference to functional, aesthetic, social, economic, and environmental considerations;
  - describes, where relevant, the principles on which decisions were based, such as aesthetic, mathematical, and scientific;
  - establishes criteria for evaluating the product, service, or system;
  - uses appropriate conventions to represent designs;
  - communicates clearly so that a peer or colleague could use it;
- organizes, implements, and adjusts the production process to:
  - achieve specified standards of quality and safety;
  - make efficient use of time and resources;
- evaluates the product, service, or system in terms of the criteria established in the design proposal, using:
  - information gathered from impact studies or product testing or market research, as appropriate;
  - comparisons with similar work done by others.

Planning and Organizing

The student plans and organizes an event or activity; that is, the student:

- develops a planning schedule that:
  - is sensible in terms of the goals of the event or activity;
  - is logical and achievable;
  - reflects research into relevant precedents and regulations;
  - takes account of all relevant factors;
  - reflects strategic thinking;
  - communicates clearly so that a peer or colleague could use it;
- implements and adjusts the planning schedule in ways that:
  - achieve specified standards of quality;
  - make efficient use of time, money, people, resources, facilities;
  - reflect established priorities;
  - respond effectively to unforeseen circumstances;
- evaluates the event or activity using qualitative and quantitative methods to determine:
  - the success of the event or activity in terms of its established purposes;
  - aspects of the event or activity that could have been improved by better planning and organization and the ways by which the improvements could have been achieved;
  - recommendations for planning and organizing subsequent similar events or activities.

Improving a System

The student troubleshoots problems in the operation of a system in need of repair or devises and tests ways of improving the effectiveness of a system in operation; that is, the student:

- explains the management and structure of the system in terms of its:
  - logic, sequences, and control;
  - impact;
  - operating principles, that is, the mathematical, scientific, and/or organizational principles underlying the system;
- analyzes the design and management of the system, taking account of its functional, aesthetic, social, environmental, and commercial requirements, as appropriate, and using a relevant kind of modeling and systems analysis;
- evaluates the operation of the system using qualitative methods and/or quantitative measurements of performance;
- adapts techniques to control and manage the system in order to improve its performance by:
  - identifying, testing, and adjusting sub-systems;
  - developing and testing strategies to optimize performance.

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APPENDIX 4

ELEMENTARY SCHOOL

The student makes an oral presentation of project plans or findings to an appropriate audience; that is, the student:

- organizes the presentation in a logical way appropriate to its purpose;
- speaks clearly and presents confidently;
- responds to questions from the audience;
- evaluates the effectiveness of the presentation.

The student composes and sends correspondence, such as thank-you letters and memos providing information; that is, the student:

- expresses the information or request clearly;
- writes in a style appropriate to the purpose of the correspondence.

The student writes and formats information for short publications, such as brochures or posters; that is, the student:

- collects information to include in the publication;
- organizes the information into an appropriate form for use in the publication;
- checks the information for accuracy;
- formats the publication so that it achieves its purpose.

The student translates information from one format to another; that is, the student:

- chooses a different format that is appropriate for presenting information to better suit the purpose for communicating it;
- checks that the information has been translated accurately into the new format;
- gives reasons for any changes made in the information, such as deciding to leave some information out.

MIDDLE SCHOOL

The student makes an oral presentation of project plans or findings to an audience beyond the school; that is, the student:

- organizes the presentation in a logical way appropriate to its purpose;
- adjusts the style of presentation to suit its purpose and audience;
- speaks clearly and presents confidently;
- responds appropriately to questions from the audience;
- evaluates the effectiveness of the presentation.

The student conducts formal written correspondence with a community organization or business; that is, the student:

- expresses the information or request clearly for the purpose and audience;
- writes in a style appropriate to the purpose and audience of the correspondence.

The student organizes and communicates information for publication using several methods and formats, such as overhead transparencies, handouts, and computer generated graphs and charts; that is, the student:

- collects information to include in published materials;
- organizes the information into an appropriate form for use in the publication, taking account of the requirements and possibilities of the chosen format;
- checks the information for accuracy;
- formats the published material so that it achieves its purpose.

The student translates information from one format to another; that is, the student:

- chooses a different format that is appropriate for presenting information to better suit the purpose for communicating it;
- checks that the information has been translated accurately into the new format;
- gives reasons for any changes made in the information, such as deciding to leave some information out.

HIGH SCHOOL

The student makes an oral presentation of project plans or findings to an audience with expertise in the relevant subject matter; that is, the student:

- organizes the presentation in a logical way appropriate to its purpose;
- adjusts the style of presentation to suit its purpose and audience;
- speaks clearly and presents confidently;
- responds appropriately to questions from the audience;
- evaluates the effectiveness of the presentation.

The student prepares a formal written proposal or report to a community organization or business; that is, the student:

- organizes the information in the proposal or report in a logical way appropriate to its purpose;
- produces the proposal or report in a format similar to that used in professionally produced documents for a similar purpose and audience.

The student develops a multi-media presentation, combining text, sound, and images; that is, the student:

- selects an appropriate medium for each element of the presentation;
- uses the selected media skillfully, including editing and monitoring for quality;
- makes smooth transitions between the elements of the presentation;
- achieves coherence in the presentation as a whole;
- communicates the information effectively, testing audience response and revising the presentation accordingly.

The student translates information from one format to another; that is, the student:

- chooses a different format appropriate for presenting information to better suit the purpose for communicating it;
- checks that the information has been translated accurately into the new format;
- justifies any changes made in the information, including the omission of material irrelevant to the purpose of the communication.

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3. Information Technology Tools and Techniques

The Grade Levels Compared: *Applied Learning*

APPENDIX 4

ELEMENTARY SCHOOL

The student:

- uses word processing, graphics, and drawing programs;
- uses an electronic card catalogue.

MIDDLE SCHOOL

The student:

- loads, runs, and uses database and spreadsheet programs;
- acquires information for specific purposes from on-line sources;
- uses documentation and on-screen help to learn how to use software programs.

HIGH SCHOOL

The student:

- sets up and operates computer equipment and associated peripherals;
- troubleshoots problems in operating computer equipment and software;
- uses on-line sources to exchange information for specific purposes.

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4. Learning and Self-management Tools and Techniques

APPENDIX 4

ELEMENTARY SCHOOL

The student learns from role models; that is, the student:

- consults with or observes older students and adults at work and identifies the main features of what they do, the way they go about their work, and the qualities of the products they produce;
- takes account of role models in planning and conducting his or her own project activities.

The student keeps records of work activities in an orderly manner; that is, the student:

- sets up a system for storing records of work activities;
- maintains records of work activities in a way that makes it possible to find specific materials quickly and easily.

The student identifies strengths and weaknesses in his or her own work; that is the student:

- understands and establishes criteria for judging the quality of work processes and products;
- assesses his or her own work processes and products.

MIDDLE SCHOOL

The student learns from role models; that is, the student:

- consults with or observes older students and adults at work and identifies the main features of what they do, the way they go about their work, and the qualities of the products they produce;
- analyzes work performances and work products to identify factors affecting success;
- takes account of analyses of role models in planning and conducting his or her own project activities.

The student develops and maintains a schedule of work activities; that is, the student:

- establishes a schedule of work activities that reflects priorities and deadlines;
- seeks advice on the management of conflicting priorities and deadlines;
- updates the schedule regularly.

The student sets goals for learning and reviews his or her progress; that is, the student:

- sets goals for learning;
- reviews his or her progress towards meeting the goals;
- seeks and responds to advice from others in setting goals and reviewing progress.

HIGH SCHOOL

The student learns from adult role models; that is, the student:

- consults with and observes adult role models at work and identifies the elements of their work roles and the qualities of the their work products;
- analyzes the work performance of adult role models to determine the critical demands of the role, such as demands for knowledge and skills, judgment and decision making;
- takes account of analyses of role models in planning and conducting his or her own project activities.

The student reviews his or her own progress in completing work activities and adjusts priorities as needed to meet deadlines; that is, the student:

- develops and maintains work schedules that reflect consideration of priorities;
- manages time;
- monitors progress towards meeting deadlines and adjusts priorities as necessary.

The student evaluates his or her performance; that is, the student:

- establishes expectations for his or her own achievement;
- critiques his or her work in light of the established expectations;
- seeks and responds to advice and criticism from others.

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APPENDIX 4

5. Tools and Techniques for Working With Others

The Grade Levels Compared: *Applied Learning*

ELEMENTARY SCHOOL

The student works with others to complete a task; that is, the student:

- reaches agreement with group members on what work needs to be done to complete the task and how the work will be tackled;
- takes a share of the responsibility for the work;
- consults with group members regularly during the task to check on progress in completing the task, to decide on any changes that are required, and to check that all parts have been completed at the end of the task.

The student shows or explains something clearly enough for someone else to be able to do it.

The student identifies the needs of a client; that is, the student:

- interprets a written request for completion of a task;
- asks questions to clarify the demands of a task.

MIDDLE SCHOOL

The student takes responsibility for a component of a team project; that is, the student:

- reaches agreement with team members on what work needs to be done to complete the task and how the work will be tackled;
- takes specific responsibility for a component of the project;
- takes all steps necessary to ensure appropriate completion of the specific component of the project within the agreed upon time frame.

The student coaches or tutors; that is, the student:

- assists one or more others to learn on the job, e.g., in school, sports, and community groups;
- analyzes coaching or tutoring experience to identify more and less effective ways of providing assistance to support on-the-job learning;
- uses the analysis to inform subsequent coaching or tutoring activities.

The student negotiates with a client; that is, the student:

- consults with a client to clarify the demands of a task;
- interprets the client's request and translates it into an initial plan for completing the task, taking account of available resources;
- negotiates with the client to arrive at an agreed upon plan.

HIGH SCHOOL

The student participates in the establishment and operation of self-directed work teams; that is, the student:

- identifies the range of knowledge and skills required for a given project;
- defines roles and shares responsibilities among team members;
- sets objectives and time frames for the work to be completed;
- establishes processes for group decision making;
- reviews progress and makes adjustments as required.

The student plans and carries out a strategy for introducing others into a work program; that is, the student:

- establishes learning goals;
- plans a sequence of activities designed to achieve the learning goals;
- monitors the learning process and revises activities accordingly;
- evaluates the success of the strategy and identifies aspects of the process that could have been improved and the ways by which the improvements could have been achieved.

The student completes a task in response to a commission from a client; that is, the student:

- negotiates with the client to arrive at a plan for meeting the client's needs that is acceptable to the client, achievable within available resources, and includes agreed-upon criteria for successful completion;
- monitors client satisfaction with the work in progress and makes adjustments accordingly;
- evaluates the result in terms of the negotiated plan and the client's evaluation of the result.

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